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ENGINEERING NEWS.

THE TRUNK LINE ASSOCIATION is much disturbed over the big cut in east-bound grain rates made by the Baltimore & Ohio. The managers of the B. & O. defend their action on the ground that they were obliged to take the step to prevent entire stoppage to the grain export business at Baltimore and to grain shipments over their road. They claim that the combined lake and rail rates out of which other roads are securing business, and the rates made by the new Cleveland, Cincinnati, Chicago & St. Louis line, are so low as to shut out the Baltimore & Ohio entirely. The Pennsylvania has met the cut at every point, but other lines are holding off for the present, trusting a peace may be patched up.

THE DAMAGE BY THE JOHNSTOWN FLOOD is reported by the Board of Inquiry convened to approach $9,000,000. They divided the losses into six classes, and put the first five at $4,791,749 covering 3,364 cases, with an average loss of $1,424. The total loss under Class 6 is $1,112,192, with 445 cases. The aggregate loss of borough property is $168,180. The damage in seven school districts is $52,132. Losses on private property so far reported amount to $1,731,662. The board has not yet heard from the Cambria Iron Co., the Johnstown Manfg. Co., or the Cambria & Westmoreland Natural Gas Co. The total loss reported to date amounts to $7,894,064; and assuming that the 491 cases not fully reported upon will average as the others $1,550 each, the grand total is estimated at $8,665,114.

THE SOUTHERN PACIFIC company has recently purchased two short narrow-gauge railways in Oregon owned by the bankrupt Oregon Company, having a total extent of about 140 miles. This gives the Southern Pacific Company control of all the railway lines south of Portland, except the Oregon Pacific, to near San Francisco. It is generally believed that the company will go on with its extension policy and that it will at an early day control lines to Astoria and Tacoma.

THE BROOKLYN BRIDGE MANAGEMENT is being radically changed since the city of New York has been taking a more active hand in the control. On July 8, a salaried treasurer was appointed at $4,000 per year, and the duties of Superintendent of Tolls were turned over to him. The offices of the superintendent of transportation ($2,000) and trainmaster ($1,800) were consolidated into those of a chief train dispatcher at $1,800. On the return of Chief Engineer C. C. MARTIN, a committee is to confer with him "on the complete reorganization of the practical management and official services of the bridge."

MISSOURI RAILROADS, telegraphs, and bridges owned by private companies are appraised by the State Board of Equalization at $55,657,279, an increase of $4,386,116 over the preceding year.

A NEW HYDRAULIC ENGINE, for pumping water or air by water power, is being erected at the Isabella Furnace, at Barneston, Pa. This is the hydraulic engine designed and patented by Mr. H. D. PEARSALL, Assoc. M. Inst. C. E., who is himself in this country superintending the installation of this novel machine, the first put up in the United States. This engine is a very much improved hydraulic ram in principle, but differing very essentially from the ordinary ram in its details. We will describe it further in another issue.

THE TEN-THOUSANDTH LOCOMOTIVE built at the Baldwin Locomotive Works was shipped lately to the Northern Pacific Railroad, for use on the mountain division. It is claimed that this engine can haul a train of 20 loaded freight cars, weighing 535 gross tons, on a grade of 116 ft. per mile combined with reversed curves of 10°. On easier grades of 1 per cent, its power is estimated at 1,000 tons. The engine, exclusive of tender, weighs 150,000 lbs. in working order. The cylinders are 22×27 ins, the drivers are 50 ins., four pairs coupled. The Baldwin works were established in 1833; in 1861 the first thousand locomotives were finished; in 1870 the second thousand went into service; in 1872, the third; in 1876, the fourth; and in 1880, the fifth thousand was completed. Another 5,000 locomotives have been built in the last nine years.

THE ABT RACK-RAILWAY system is to be adopted for a line in Bosnia, over the Ivan mountains, between Sarajevo and Mostar, to establish a direct connection between Hungary and the Adriatic sea, through Bosnia. The gauge is to be 25 ins. Mr. ABT, the inventor of the system, has received a contract for 13 years from the Austrian Government for this line.

AN ACCIDENT to the excursion steamer *Sylvan Shore* last Sunday afternoon while near Randall's Island, with a load of excursionists on board, came near having serious consequences. A dense smoke suddenly came pouring up from the engine room, filling every part of the boat, and the cry of fire was at once raised. In the panic which ensued, a large proportion of the passengers were on the point of jumping overboard when the steamer *Osseo* came alongside and took them off. After the panic subsided it was found that the smoke was due to the felt packing covering the main steam pipe, which had become overheated and taken fire.

Apart from the danger of such a fire spreading where surrounded by the oily woodwork of the engine room, is the danger from the panic which the smoke from felt packing is certain to create. In these days, when incombustible coverings of asbestos, mineral wool, etc., are so abundant and cheap, their use in such places as the above should be universal.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a head collision, July 6, between a passenger and freight train on the New York, Pennsylvania & Ohio Ry. near Kennedy, N. Y. Both engines and several freight cars were wrecked, and the baggage and smoking cars of the passenger train were telescoped. There were 2 men killed and 3 injured. It is stated that the engineer of the freight train, who was killed, should have waited at Kennedy for the passenger train to pass.—Another serious accident was the derailment of a freight train, July 8, on the Pennsylvania R. R. near Wilmerding, Pa. The accident was caused by a broken car-wheel or axle. The train consisted of 37 cars hauled by two engines; 13 cars and 1 engine were derailed and the wreck caught fire. There were 3 persons killed, and 5 or 6 injured.—The breaking of an axle of the engine of a passenger train on the Pittsburg & Western Ry. near Akron, O., July 7, caused the derailment of the engine. The engine driver was killed.

THE REPORT OF TROUBLE on the Nicaragua Canal is without foundation, says Señor ZELEDON, Minister from Costa Rica. He returned on July 8 from a visit to his country, and denies that Costa Rica ever opposed, or is likely to oppose, the construction of the canal. London papers say that French agents have been fomenting trouble in the interest of the defunct Panama Canal, and that they offer money and arms to Costa Rica if that State will insist upon the terms of the treaty of 1858 which gave both countries equal fluvial and riparian rights on the San Juan river from its mouth to Castillo Falls. On the basis of this treaty a claim could be founded that the late party in power in Costa Rica had no legal right to cede inalienable territory, and charge the act to bribery. But parties closely watching American interests there fear no trouble.

NEW HAMPSHIRE RAILROAD matters are at last to be settled and the railroad question will no longer be the chief issue in State politics. Representatives of the Concord and the Boston & Maine companies have finally agreed upon a bill whose passage they will try to secure in the Legislature. Under its provisions the Northern Railroad and its branches will become part of the Boston & Maine system while the Concord will absorb the Boston, Concord & Montreal.

THE FORDYCE DAM, near Washington, Nevada Co., Cal., is described by the Nevada City *Herald* as being 100 ft. high, about 100 ft. thick at the bottom and 30 ft. thick at the top. The inner face has a slope of 45°. It is founded on solid rock and is built of masonry, and the water level is controlled by a bottom-gate. When the dam was only 75 ft. high, the water flooded 750 acres and the storage capacity was 725,000,000 cu. ft. This quantity is of course vastly increased by the raising of the crest 25 ft., but the exact amount is not stated. The dam cost $175,000.

THE INSTITUTION OF CIVIL ENGINEERS, according to the last annual report, numbered 4,739 members of all classes on March 31 last, with an increase of 4 per cent. over previous year. This number is distributed: honorary members, 19; members, 1657; associate members, 2613; associates, 450. At the same date there were 989 students on the rolls. In the year just past there were 25 ordinary meetings, but only 14 papers had been read and discussed. At 12 supplemental students' meetings 13 papers were read and discussed. The gross revenue of the year was £21,763, 18s. 4d., and the total expenditure was £18,226, 7s. 1d. The total investments amount to £98,042, 13s. 10d.

IRON TUBE CARS are being manufactured at Kansas City by the Centropolis Car & Machine Co. The frame of these cars is made entirely of tubes, with from 2,000 to 5,000 lbs. less weight in the car and a claimed increased carrying capacity over wooden cars of from 10,000 to 40,000 lbs. An iron-tube coal car weighing 24,000 lbs. will carry 60,000 lbs. Five years' use has demonstrated their good qualities.

INVENTIONS BY ENGLISH RAILWAY EMPLOYEES are assumed to be the property of the employer, as far as use free of charge is concerned. At least that is the opinion of the Lancashire & Yorkshire Railway Co., which on June 4 issued a circular requiring its "officers and servants" to sign an agreement to that effect. This unwise act, of sheer confiscation of the work of other men's brains, should recoil on the company in effectually stopping any attempt at improving on old details or methods in the management of the company's affairs.

THE MONTREAL TUBULAR BRIDGE, according to a current rumor, is threatened with removal and the erection of a modern truss bridge upon its piers by the officials of the Grand Trunk Railway. The estimated cost of the change is set down at about $1,000,000. The rumor is without substantial grounds, however.

THE AMERICAN ENGINEERS in Paris were given a banquet on July 4, by the English Institute of Mechanical Engineers at the Hotel Continental. Mr. COCHRAN presided, and leading English and French engineers were present.

MORE SIXTEEN-STORY BUILDINGS are being built in Chicago. The "Monadnock" is to cover a lot 273 x 67 ft., and will be 200 ft., high. The "Manhattan" building is to be sixteen stories high on a lot 150 x 68 ft., and will cost $900,000.

THE PUBLIC LAND SURVEY APPROPRIATION, of $200,000, is to be divided as follows: Arizona, $5,000; California, $10,000; Colorado, $15,000; Dakota, $25,000; Idaho, $10,000; Minnesota, $5,000; Montana, $25,000; New Mexico, $10,000; Utah, $5,000; Washington, $20,000; Wyoming, $10,000.

CONCERNING CITY ENGINEERS the Denver *Republican* publishes the following solid chunk of wisdom:—"The Board of Public Works should select its own engineer. That is the clear intent of the charter, and it must not be overlooked or set aside. Neither is it reasonable to expect that a fit man for the place can be procured for $2,500 a year. An unfit or incompetent engineer would be dear at any price, and a good one can save his salary ten times over, even though he should be paid $4,000 a year."

NAPLES, so long notorious for its unsanitary conditions, has commenced house-cleaning on an unparalleled scale. The plans now being put into effect contemplate the removal of 17,000 houses and 62 churches in the thickly populated centre of the city, and these are to be replaced by better houses and broad streets. In the quarter to be renovated the population now is 108,000, or 600 per acre. The payments to the owners of these houses will alone amount to $18,750,000, says a London exchange.

BRICKLAYING IN WINTER.—The singular fact is mentioned that while in Great Britain, building operations are suspended on the slightest approach of frost, bricklaying is carried on in Norway during almost the coldest weather that prevails. Thus, in Christiania, building during the winter months, it is stated, has now been practised for at least twelve years, but more frequently during the last five, all the buildings thus erected having stood remarkably well. Experience has not shown that walls built in winter exhibit subsequently more dampness than those erected in summer. The reverse may be the case, since the difference between the temperature of the air and the mortar cools the latter by evaporation and takes away a great part of the moisture. According to the opinion of the principal builders in Christiania, bricklayers' work executed with due care in winter is really superior to similar work done in summer—the whole art of such work in frosty weather consisting simply in the use of unslaked lime, the mortar prepared with which is to be made in small quantities immediately before use, the proportion of lime being increased as the thermometer falls; the only care required is to utilize the unslaked lime so handily and quickly as to enable the mortar to bind with the bricks before it cools. Another very important condition is that the bricks be always kept covered on the building site.—*Exchange.*

THE JOHNSTOWN CORONER'S JURY, which was convened to enquire into the cause of the death of ELLEN HITE, one of the victims of the flood, has been in session some time, and on July 6th it returned the following verdict:—

"We the undersigned, the jury of inquest impaneled to investigate the cause of the death of Ellen Hite on the day of the 31st of May, after hearing the testimony, do find that Ellen Hite came to her death from drowning and that the drowning was caused by the breaking of the South Fork dam.

"We further find from the testimony and what we saw on the ground that there was not sufficient waste weir, nor was the dam constructed sufficiently strong, nor of the proper material to withstand the overflow, and here we find that the owners of the said dam were culpable in not making it as secure as should have been done; especially in view of the fact that a population of many thousands was in the valley below.

"We hold the owners are responsible for the fearful loss of life and property resulting from the breaking of the dam."

Competition of Canadian Railways with American Lines.

United States Senators CULLOM, GORMAN, BLAIR, HARRIS and REAGAN, of the Senate Committee on Interstate Commerce, met at the Massachusetts Railroad Commissioners' office in Boston on July 5, to continue their investigation of the competition of Canadian with American railways.

President WM. BLISS of the Boston & Albany was the first witness called. He said he was not in favor of preventing the Grand Trunk from doing business in the United States, provided it was subjected to the same rules and regulations as American roads. If it was just to regulate American roads so that they could not compete with the water lines, it was just to regulate Canadian roads to prevent them from preying on the American roads after the latter were tied up by the Interstate law. The Interstate law had been in the main beneficial. It would have been more so had it been more strictly enforced. If the law were fairly enforced on both sides, and honestly carried out, the business of the American roads would be increased so that they would carry traffic between Boston and the West cheaper than at present and cheaper than Canadian roads could afford.

President CHOATE of the Old Colony said his company was very little affected by the Interstate law. To place Canadian lines under the same restrictions as American would be a good thing, but he did not see how it was possible to do it. He thought there had been an increase in the shipments over Canadian roads since the passage of the law. The only good effect of the Interstate law had been to stop temporarily the building of railroads. The long and short haul clause would never be enforced. Some system of pooling would be the best thing.

General Traffic Manager WHITMORE of the Fitchburg, believed that New England would have as cheap transportation if Canadian roads were shut out, and that American roads were seriously injured by their competition. He favored more restriction upon railway building.

General Traffic Manager C. S. MELLEN of the Union Pacific said that his road competed with the Canadian Pacific for transcontinental traffic. The Canadian Pacific was getting a larger and larger share of this through its large differentials and the fact that it did not have to scale local rates by through ones as did American roads.

At the Saturdays session representatives of various commercial associations of Boston and Portland appeared before the committee. They were unanimously of the opinion that the competition of Canadian roads benefited New England and were opposed to any movement to shut them out. They were well satisfied to let things remain as they are.

The final session was held on Monday. President E. B. NEALLY, of the Bangor & Piscataquis Ry., and representatives of the Bangor Board of Trade, told the committee how important it was to Bangor that the Canadian Pacific line should be given every facility for its transportation of through traffic from the West. J. M. DEVEREAUX, of Bangor, represented the interests of the Castine & Bangor Railway company and the town of Castine. It is desired to make the latter town an important port for export of the through traffic from the West over the Canadian Pacific.

PSESIDENT J. GREGORY SMITH of the Central Vermont system spoke strongly against any scheme for shutting out Canadian roads. He thought the Grand Trunk was now complying with the Interstate law at every point. JAMES P. FURBER, General manager of the Boston Maine system, indorsed President SMITH's statements. Any disturbance of the present relations with Canadian roads would work serious injury to the territory covered by the Boston & Maine.

ALDEN SPEARE, President of the Boston Chamber of Commerce; President BORDEN of the Fall River Board of Trade; and Ex-Gov. WM. CLAFLIN, representing Boston merchants, were among the other witnesses. The latter declared that the Interstate Commerce law had worked injury to New England's manufacturing mmerc terests.

SENATOR CULLOM then declared the hearing adjourned to Detroit, Mich.

Portal Bracing.*

The analysis of the stresses in the portal bracing of through bridges has not, as far as I know, received all the attention it deserves. The brief presentation of the subject given on page 475 of ENGINEERING NEWS for May 25, 1889, and attributed to Mr. W. H. DAWSON, although a step in the right direction, does not seem to me to present the whole case, and I therefore offer the following solution:

It might be well to give first a simpler example of a structure whose stability is dependent upon the resistance of one or more pieces to flexure in addition to the longitudinal stresses exerted in all the pieces, since the problem is not so simple but that mistakes are easily made; but for fear of taking up too much of your valuable space, I shall at once proceed to the case in hand.

In the accompanying Fig. 1, $A\ E$ and $B\ F$ represent the end parts of a through bridge, both under a certain amount of flexure from the wind force P acting horizontally at B upon the posts and postal bracing consisting of the parts $A\ B\ A\ D$ and $C\ D$. The piece $A\ D$ is supposed to be capable of taking tension only, and the pieces will be supposed free to turn at joints A, B, E and F.

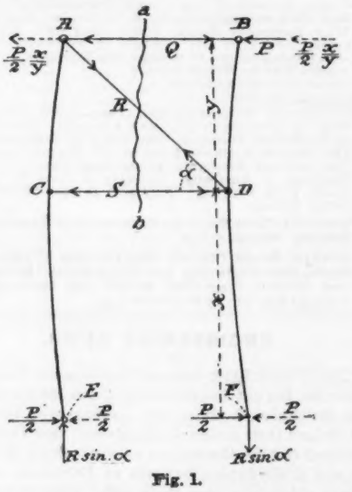


Fig. 1.

The horizontal reactions at E and F are each equal to $\frac{P}{2}$ as shown by the dark arrows, since the wind force P (which represents half the total pressure on top chord as transferred by the upper lateral bracing) has to be ultimately resisted by the abutment at E and F, and if the posts are of equal strength, half should be carried by each post.

Call the stresses in $A\ B$, $A\ D$ and $C\ D$, Q, R, and S respectively. It is evident that $C\ D$ must be in compression. In fact, conceive a section $a\ b$ cutting $A\ B$, $A\ D$ and $C\ D$, that the part of the truss to the right of $a\ b$ is removed, and that forces Q, R, and S are applied at the cut sections, equal to the stresses there, and acting in the directions corresponding to the actions of the part of the truss to the right of the section $a\ b$ upon the part to the left. These forces with the reactions at E must then constitute a system in equilibrium; so that, taking moments about A, we have,

$$\frac{P}{2}(x+y) = S\,y$$

$$\therefore S = \frac{P}{2}\frac{x+y}{y},$$

and S must act to the left to cause equilibrium, corresponding to compression in $C\ D$.

Similarly, suppose the frame to the left of $a\ b$ to be removed; on supplying forces Q, R, and S at the cut parts, exactly equal to the action of the left part upon the cut pieces, we have again a system in equilibrium, consisting of the forces Q, R, acting away from D, S acting toward D, P at B and reactions at F. On taking moments about B we have, calling α the angle that $A\ D$ makes with the horizontal,

$$(R\cos\alpha \qquad \frac{P}{2}(x+y).$$

since $\frac{P}{2}$ at F acts to the right, the total horizontal

*By Prof. WM. CAIN, Charleston, S. C.

force at D ($R \cos \alpha - S$) must act to the left to cause equilibrium; its amount is $\frac{P}{2}\frac{x+y}{y}$.

On substituting the value of S just found, we obtain the tension in $A\,D$,

$$R = P.\frac{x+y}{y}\sec \alpha.$$

The total horizontal force at D, $\left(\frac{P}{2}, \frac{x+y}{y}\right)$ acting to the left, causes bending in the beam $B\,F$, and by the law of the lever, part of it $\left(\frac{P}{2}\right)$ is transferred to F (dotted arrow) and the remainder $\left[\frac{P}{2}\frac{x}{y}\right]$ to B (dotted arrow).

The part at F exactly balances the *horizontal component* of the reaction $\frac{P}{2}$ there, and the part transferred by flexure to B is to be added to the force P at B to get the total stress on $A\,B$, which is directly opposed to the wind force P and the force at B due to the spring of the beam, and is therefore compressive and equal to

$$Q = P + \frac{P}{2}\frac{x}{y}.$$

Referring again to the left post, we have found S acting to left at C and equal to $\frac{P}{2}\frac{x+y}{y}$; so that the post $A\,E$ is in the condition of a beam supported at A and E and loaded at C with S; so that by the resistance to flexure, part of S, $\frac{P}{2}$ (dotted arrow) is transferred to E, and the remainder $\frac{P}{2}\frac{x}{y}$ (dotted arrow) to A.

The part $\frac{P}{2}$ transferred to E exactly balances the horizontal component of the reaction there, and the part at A constitutes a force, acting to the left, which should cause equilibrium with the longitudinal stresses in the members assembled at A. As a check, therefore, we have the algebraic sum of the horizontal forces acting at A equal to zero,

$$\therefore \frac{P}{2}\frac{x}{y} + Q - R\cos\alpha = 0;$$

which, on substituting the values of Q and R found above, is found to be verified.

We have thus found the longitudinal stresses.

S (*compression*) $= \frac{P}{2}\cdot\frac{x+y}{y}$,

R (*tension*) $= P\frac{x+y}{y}\sec.\ \alpha$

Q (*compression*) $= P\left(1+\tfrac{1}{2}\frac{x}{y}\right)$

and from the pull of the tie $A\,D$, a uniform compression of post $A\,E = R\sin\alpha$ and a uniform tensile stress in post $D\,F = R\sin\alpha$ (both resisted by the vertical reactions shown at E and F), always supposing that the members are assembled on pins passing through the centers of gravity of their cross sections, otherwise the eccentricity will cause additional stresses that must be provided for in the usual manner.

Now, in addition to the unit stress due to the longitudinal stresses $R\sin\alpha$ in the post, we have to add the fibre stress due to flexure, which is a maximum at C or D, where the bending moment is $\frac{P}{2}x$.

If the wind blew from the left, a tie would have to connect B and C, and it may now be inquired whether the two members, $A\,D$ and $B\,C$, may not act at the same time. If they are of such small section that they can take no appreciable compression, when one is under stress and lengthened, the other is necessarily shortened from the known form assumed by the distorted rectangle $A\,B\,C\,D$, and is thus out of action.

For fear it may be thought that the wrong diagonal, $A\,D$, has been supposed in action for wind blowing from right, suppose it removed and diagonal $B\,C$ inserted; then, taking moments about B of forces acting on frame to right of section, we see that S must now be tension, whence it follows that stress in $B\,C = R'$ must be compression, since the total horizontal force at C must act to left. Now this force is ($R'\cos\alpha - S$) which can only be positive when $B\,C$ is in compression; but as this cannot obtain, we conclude that $A\,D$ is in action as assumed.

Next suppose that the beams $C\,E$ and $D\,F$ are "fixed at the ends" E and F, through the pin connection, as well as at C and D. The parts $C\,E$ and $D\,F$ will have vertical tangents at the ends and will be bent into reversed curves with a point of inflection at their middle. The moment there is zero, and we necessarily have the total wind force P resisted at these points, so that we can consider the reactions $\frac{P}{2}$ and $R\sin\alpha$ transferred from E and F to points at distances $\frac{x}{2}$ vertically above E and F, and the preceding investigation holds throughout on simply replacing x by $\frac{x}{2}$; or better, if we call the distance $C\,E = F\,D = x$, the preceding formulas all hold exactly as they are written.

This differs from the solution indicated on page 475 of the current volume, where the total force acting to the left at B was assumed to be equal to $P \times \frac{BF}{BD}$, whereas, as we have just found, the total force at B to be $P + \frac{P}{2}\frac{x}{y}$. This, added to the force $\frac{P}{2}\frac{x}{y}$ at A, gives $P\frac{x+y}{y} = P \times \frac{BF}{BD}$, if there is no bending moment at E and F as first supposed; but this total horizontal force at top is only

$$\frac{P}{BD}(B\,D + \tfrac{1}{2}\,DF)$$

if the lower ends of the posts are fixed, by the moments M' as in Fig. 2.

The proof for Fig. 2 is after the general method above and will be only briefly indicated. Thus, adopting the notation of the figure and regarding

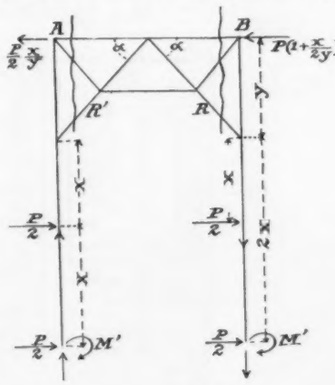


Fig. 2.

the reactions as acting at distances x above the bottom of the posts where there is no bending moment, take moments about A of forces acting on part of truss to left of section, shown by the wavy line near A, which forces are in equilibrium. We have,

$$\frac{P}{2}(x+y) = R'\cos\alpha\, y.$$

Similarly, on taking moments about B of the forces acting on the part of the truss to the right of the section, shown by the wavy line near B, which forces are in equilibrium, we have,

$$\frac{P}{2}(x+y) = R\cos\alpha\, y$$

R' is thus found to be in compression and numerically equal to R, which is in tension. The two horizontal forces $R'\cos\alpha$ and $R\cos\alpha$ cause flexure of the posts, and part of this common load $= \left[\frac{P}{2}\right]$ is transferred by the resistance to flexure of the posts to a point x below its point of action on each post, and the remainder $= \frac{P}{2}\frac{x}{y}$ is transferred to A and B respectively, exactly as we found before. The stresses for this form of bracing can now be found by usual methods, and to the longitudinal fibre stress in the posts we must add that caused by the bending moment $\frac{P}{2}x$ at the distances y below A and B.

In case there is doubt in the minds of any as to considering the reactions $\frac{P}{2}$ as acting x above the bottom, it can be removed by considering $\frac{P}{2}$ as acting as before at the bottom of the post, but including the bending moments M and M' at the bottom in the computation. As the bending moment, x above bottom of post is zero, we have $M = M' = \frac{P}{2}x$ and right-handed. Now as above, take moments about A (Fig. 2) of all forces acting on frame to left of section near A.

$$\frac{P}{2}(2x+y) - M' = R'\cos.\ \alpha.\ y$$

On substituting $M' = \frac{P}{2}x$, we get,

$$\frac{P}{2}(x+y) = R'\cos.\ \alpha.\ y$$

as before, similarly for $R\cos.\ \alpha.\ y$.

There is another way of considering structures where some of the members have to resist flexure to maintain stability, given by Bow in his "Economics of Construction." This consists in supplying imaginary forces exactly equal and opposed to the forces which cause bending, so that the frame is freed from all transverse stress. The longitudinal stresses are then found by a stress diagram or calculation. If now forces equal and opposite to the imaginary forces are supplied, the frame is in its original condition, so that by the principle of superposition of stress, we have only to add to the longitudinal stresses first obtained the stress due to the bending under forces equal and opposite to the imaginary forces on the piece subjected to the continued stresses.

Thus in Fig. 1, supply an imaginary force at D acting to the *right* and equal to the bending force previously found at $D\left(=\frac{Px+y}{2\ y}\right)$; also add components $\frac{P}{2}$ at F and $\frac{P}{2}\frac{x}{y}$ at B, both acting to the *left*. The system is thus still in equilibrium, but without transverse stress, since the two forces at F balance.

The force at B is now as before, $P + \frac{P}{2}\frac{x}{y}$.

Similarly we supply an imaginary force at C equal to that at D acting to the *right*, and its two components, shown by the dotted arrows at A and E, acting to the left. The longitudinal stress under this system of forces is the same as before, and the bending stress can be dealt with separately as indicated. This method permits of a stress diagram, which to complicated bracing, as in Fig. 2, is often a convenience.

When the two inclined members proceeding from A and B, Fig. 2, are omitted, as well as the horizontal member connecting their feet, the forces are found as before to be,

$$R' = \frac{P}{2}\left(\frac{x+y}{y}\right)\sec\alpha = R,$$

remembering that R' is compression and R tension. When in addition the inclined struts, whose stresses are R and R', are separated at their top, along the beam $A\,B$, a distance d (see Fig. 3), the vertical components of R and R' constitute a couple whose moment is ($R\sin\alpha.\ d$) and the beam must be stiff enough for its whole length to meet the additional stresses induced. Let F represent the upward reaction of the part of the right post $B\,D$ at B (compression) and F' the tension in part $A\,C$ of left post, both due to the vertical components at G and H which have to be transferred to A and B by flexure. Taking moments about either A or B of these forces, we find,

$$F = F' = \frac{R\sin.\ \alpha\ d}{A\,B} = \frac{P}{2}(x+y)\ \frac{d}{a},$$

calling $A\,G = H\,B = a$.

The maximum moment in beam $A\,B$ is at G or at H, and is equal to $Fa - \frac{P}{2}(x+y)\,d$.

As this is a very common case of bracing, it may be well to state the results, where x represents the distance DF, Fig. 1, if the feet of the posts are not "fixed at the ends," or half this distance where they are, as in Fig 2.

R (*compression*) $= \frac{P}{2}\frac{x+y}{y}$ *sec* α

R (*tension*) $= \frac{P}{2}\frac{x+y}{y}$ *sec* α

As AB is divided now into three parts, the stress

in part next $B = P + \frac{P}{2}\frac{x}{y}$; in the middle part $= \frac{P}{2}$ both compression; and in the segment next A, tension $= \frac{P}{2}\frac{x}{y}$. The longitudinal tension in the lower part of the right post $= R \sin \alpha - F$, and for the corresponding part of the left post compression $= R' \sin \alpha - F$, the bending moment at the point of intersection of the braces being as before given $\frac{P}{2}x$. The longitudinal stress in the posts can be found directly by moments as a check. Thus in Fig. 1, consider the frame as acted on only by P at B, the horizontal forces $\frac{P}{2}$ at E and F, and the vertical reactions V and V' at E and F respectively. Taking moments about E, we have,

$$P(x+y) = V' \times \overline{EF} \therefore V' = P.\ \frac{x+y}{EF}.$$

Now the reaction previously found reduces to this. Thus: $R \sin \alpha = P\ \frac{x+y}{y} \sec \alpha \sin \alpha = P\frac{x+y}{y} \tan \alpha = P\ \frac{x+y}{EF}$.

Similarly, taking moments about F, we find $V = V'$ acting as shown, V down and V' up.

For Fig. 2, conceive posts severed by a horizontal plane at a distance x above bottom at the points of inflection, and supply forces $\frac{P}{2}, \frac{P}{2}$ V and V' at the cut parts. On taking moments about either post at the cut parts, we find as before, $V = V' = P\ \frac{x+}{AB}$ which should equal the sum of the vertical components of R and stress in diagonal passing through B.

But as this is exactly equal to $R \sin \alpha$

$$= \frac{P}{2}\frac{x+y}{y}\frac{y}{\frac{1}{2}AB} = P\ \frac{x+y}{AB},$$

we conclude there is no stress in the inclined members proceeding from A and B (Fig. 2), so that they may be omitted as well as the horizontal member connecting their feet.

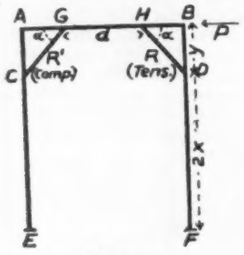


Fig. 3.

For Fig. 3, we easily show that the stress, $R \sin \alpha - F = R' \sin \alpha - F$ reduces to the value $V = V'$ found for the other figures, so that the work is completely checked.

The methods given above for portal bracing apply equally well to similar bracing between intermediate posts, designed to stiffen the posts and to transfer the *panel* load of wind force (P) on the upper chord of the windward truss to the lower chord of the leeward truss, also the reactions V and V' give the excess loading on the two vertical trusses due to wind force.

The Judson Pneumatic Railway System.

With the multitude of patents already in existence for propelling street-cars, it would be but natural to suppose that future inventors had little left them other than some further improvement upon methods in use. But in the street railway system about to be described the direct motive power is independent of horses, steam, electricity, compressed-air motors on the car or cables. It is, in fact, a new departure, differing most essentially from all previous schemes for producing similar results.

As will be better understood by examining the accompanying illustrations, the Judson system is founded upon a new mechanical movement, a new method of converting rotary into rectilinear motion. It is a screw, but *without* a thread; and this screw, though always revolving in one direction, will send the cars in either direction, and do this by a pure and simple rolling and not a sliding friction. But to understand this novel and at first puzzling mechanical movement, it is best to refer at once to the cuts shown.

In Figs. 1 and 3 we have illustrated the controlling principle of this invention. Instead of a cable, a line of coupled steel tubing (A), about 12 ins. in diameter, is run in a subway and supported at intervals by pillow-blocks. At long intervals this line of tubing is revolved at a constant speed by any power desirable, whether water, steam, or electricity; though the introducers of this system give several good reasons for preferring compressed air above other motive powers. Successful practice in England and France has demonstrated the fact that compressed air is one of the best and most economical methods of transmitting power from a central station to other stations for use at varying distances, and its application is less liable than that of other powers to introduce any element of danger or create a nuisance of any description on the line of our public highways.

Fig. 1.

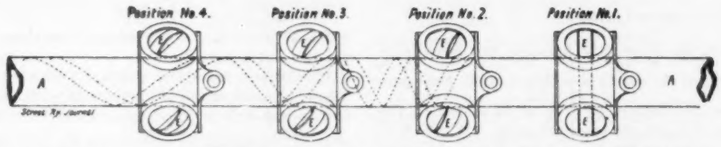


Fig. 1. Judson Pneumatic Railway System, Diagram of Motor Shaft.

Coming back to the tube itself, in Fig. 1 A represents a hollow cylinder with a perfectly smooth surface rotating on its axis continuously in one direction; E E are friction wheels resting on opposite quarters of the drum A and adjustable in the planes of their axes, and like the drum having a perfectly smooth periphery. When in contact with the moving drum and in the position No. 1, these wheels simply rotate without imparting any linear impulse. But turn them slightly into the position shown in No. 2, and they move forward on the path of a finely threaded screw, as shown by the dotted lines, with adhesion between the surfaces taking the place of the regular screw and nut. In No. 2 position, the speed is slow, but tractive power is great, just the quality of power best adapted to starting a car from a state of rest. When the start is made, more speed is wanted, and the tractive power can be safely reduced by gradually assuming the positions 3 and 4 in Fig. 1. This change in the position of the motor-wheels is smooth and gradual and the application and economy of power is self-evident to every mechanical engineer.

The reverse of these movements, from No. 4 to No. 1, brings the car gradually to a stand-still again; or if the movement of the friction wheels is continued until No. 2 stands in the direction opposite to that shown in the cut, the motion of the car will be reversed, and it will back with the same speed

Fig. 3.

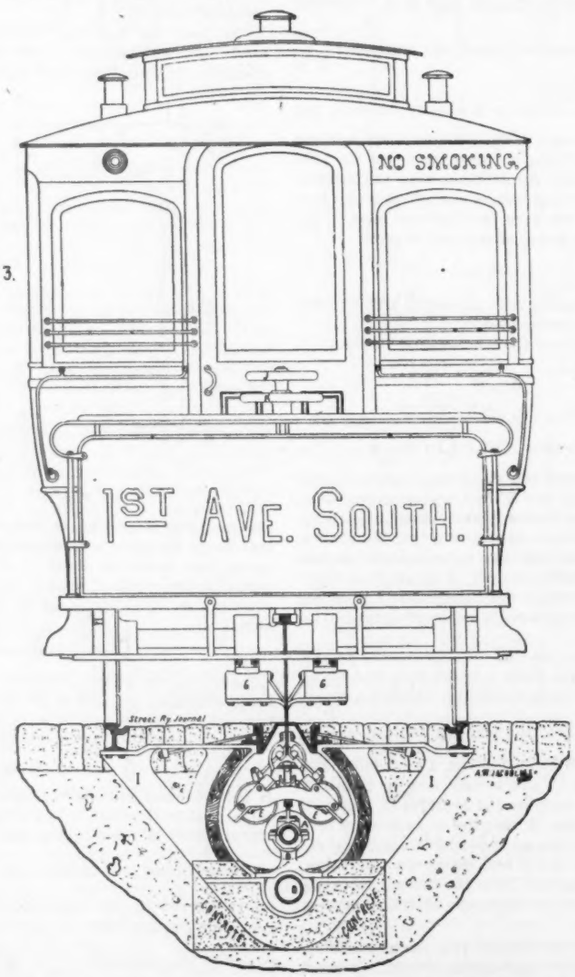


Fig. 3. Judson Pneumatic Railway System. End View of Car and Motor.

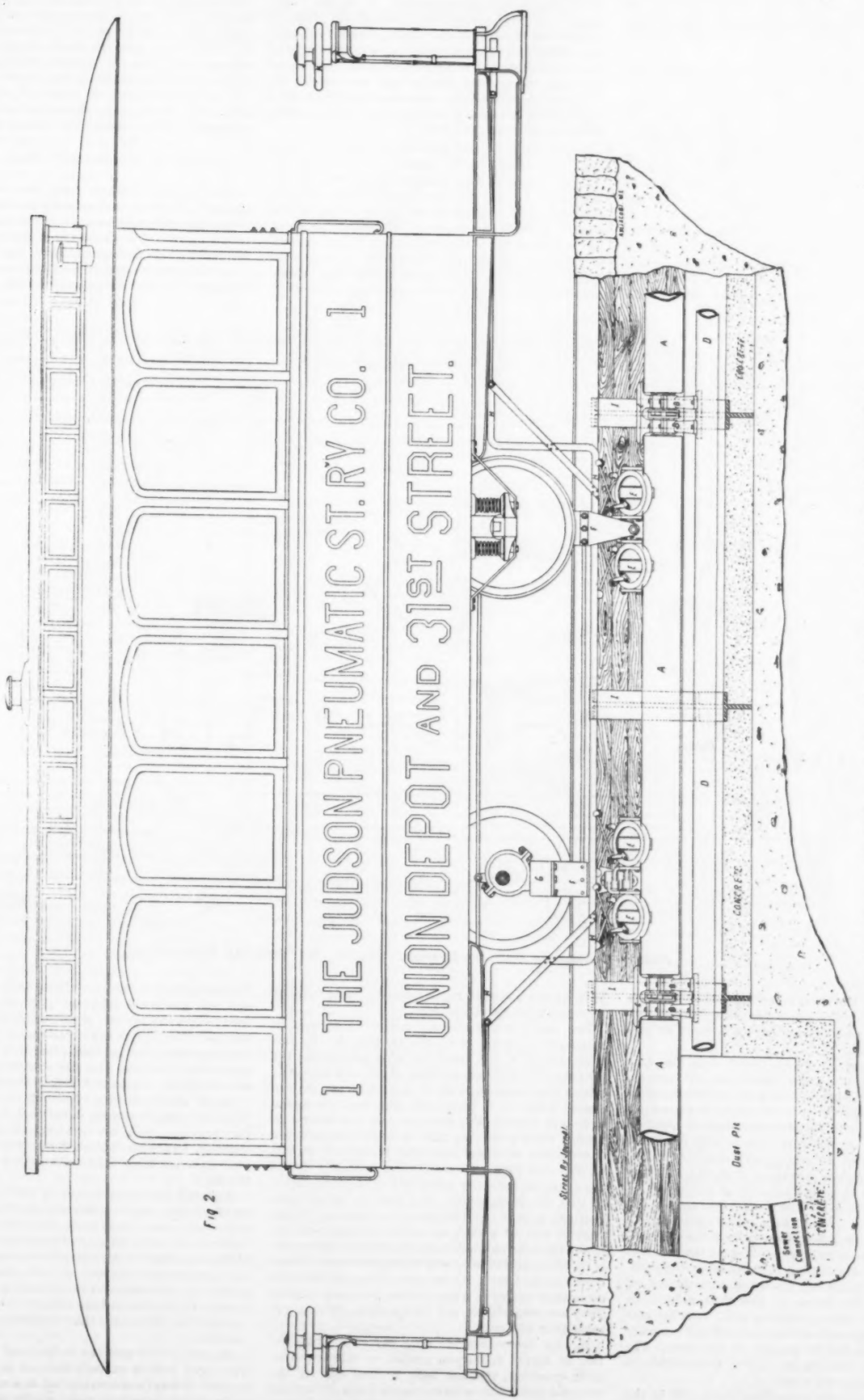


Fig. 2. The Judson Pneumatic Railway System, Longitudinal Section of Conduit and Motor.

and power it had in moving forward, and accomplish this with the drum *A* still rotating in its former direction. Thus, with one simple lever connected with these friction wheels, the operator can start, stop, reverse, and vary at will the speed of the car.

Fig. 2 shows a longitudinal section of the car-propelling mechanism and the conduit. As it stands, the plane of the friction wheels is at right angles to the axis of the drum, and the car is stopped. On the front platform are two hand-wheels, superimposed. The wheel *J* is rigidly fastened to a rod terminating in a cog-pinion under the car platform, and this pinion is in mesh with two racks, one on either side, which are rigidly connected with the lever *H*. This last lever passes down into the conduit, and is linked by ball-and-socket connections with the spiders which support the friction wheels *E E*. By this connection, when the operator slightly turns the hand-wheel *J*, all of the friction wheels on one side of the drum are thrown to a certain angle, and all the wheels on the other side are thrown to exactly the same pitch line in the opposite direction, and the car moves foward as previously described.

The hand-wheel *K*, shown under *J* in Fig. 2, is used as follows: As the minimum of pressure between the friction wheels and the drum *A* is desirable, this pressure is normally supposed to be just sufficient to maintain the desired speed on a level track. A grade or a curve will of course present a greater resistance and demand an increase in the tractive power to overcome it. This increase is gained by taking hold of the wheel *K*, which is fixed to a hollow shaft surrounding the stem of *J*, and by a slight turn operating eccentrics which throw as much of the weight of the car upon the friction wheels as is desired to gain the required tractive force. By turning *K* in the other direction, the friction wheels can be lifted entirely out of contact with the drum *A*, and thus reduce the wear and tear when standing still. Similar sets of wheels at both ends of the car avoid any necessity for turning the car at the end of the route. The wheels *E E*, in position No. 1, Fig. 1, constitute in themselves a powerful brake.

In Fig. 2 *A* is the propelling drum; *B* is the pillow-block in which the journals of *A* rest, completely housed over to protect it from dust and dirt; *C* is a "bridge rail" to carry the friction wheels over the space left at the journals; *D* is the tube conveying compressed-air; *F* is the "slot-blade," or the connection between the friction wheels and the car; *G* are "spring-boxes" containing coiled springs and connected with the axle of the car through the eccentrics, with the purpose of relieving the friction wheels from any sudden jar or pounding arising from unevenness of track, etc.; and *I* is the cast-iron yoke, similar to those used in cable construction, but lighter.

The depth from street surface to base of the concrete foundation to the conduit is 3 ft., and the conduit proper is 2 ft. deep by 22 ins. wide at the widest point. The bottom of the conduit is smooth and shaped to form a gutter on each side of the drum. A brush or scraper could easily be attached to the framework of the friction wheels and so used as to gather up all dirt and deposit it in pits (as shown in Fig. 2). The top of this conduit is also removable (see Fig. 3), and can be lifted out in 10 12 ft. sections so that repairs may be made without tearing up the street surface.

The small compressed-air engine to be used in rotating the drum is shown in Fig. 4. In this illustration, *M* is a small air pipe conducting the air from the main supply pipe *D* into the heater *L*, where the compressed air is heated to any desired degree before it is permitted to go into the engine cylinders through the governor. *N* is a lever connected with a clutch, and by it the engines are thrown into or out of gear with the drum. It will be observed that one set of these cylinders drives the drum on both the going and the coming track, so that one main supply pipe and one set of connections only is required for each engine. These engines will be placed as shown, beneath and between the two tracks, in a pit provided for them, and it is believed that they will be required not oftener than once in 1,500 ft. on straight lines, and perhaps somewhat nearer if many curves are encountered. They are very simple and inexpensive, costing not more than $200 each.

In this connection we may say that every detail in regard to curves, grades, switches or turn-outs, crossings, etc., has been worked out by the inventor until this system stands forth with such completeness as to be at once a marvel to outsiders and a tribute to the genius of the inventor. The system is peculiarly adapted to elevated railroads and would relieve the structure greatly and abate all nuisances. As the cars can be run in either direction at the will of the operator, and switches or turn-outs are easily provided, it is also applicable to single-track lines in small or suburban cities where traffic will not warrant double tracks. The offices of the Judson Pneumatic Street Railway Co. are in rooms 143, 144, 145 Aldrich Court, 45 Broadway, New York City, where further information concerning this new departure can be obtained.

Fig 4

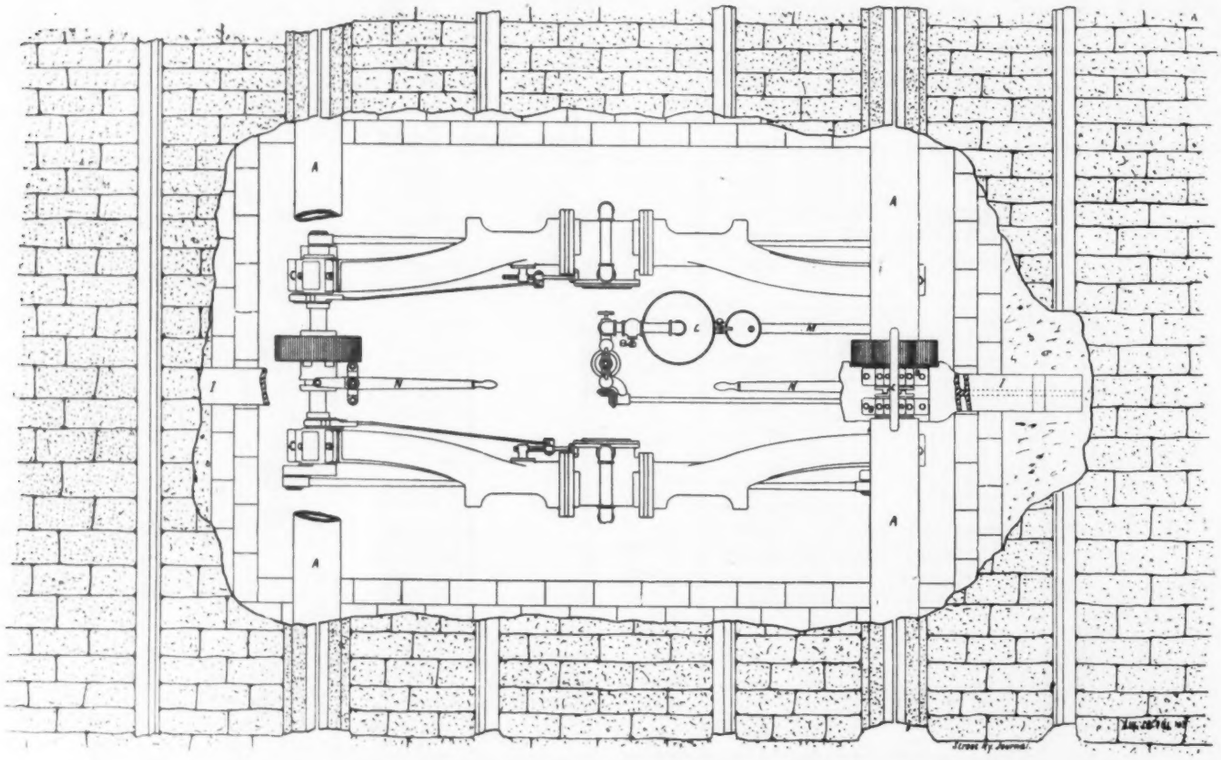


Fig. 4. Judson Pneumatic Railway System. Engine for Rotating Motor Tube.

History of the South Fork Dam.

The following extracts from the Canal Commissioners' report of various dates will be of interest as showing the progress of this now famous work.

Jan. 1, 1841.—The site of the Western Reservoir is on the Little Conemaugh river, about ten miles above Johnstown, and two miles from the Portage Railroad. It was commenced during last spring. The clearing is nearly completed, and the pipe cast and now ready for delivery. All the work at the dam below the surface of the water in the stream has been done except the sluice walls. If the necessary appropriation be made, the work can be completed and brought into use sometime during the next summer. Estimated cost, $188,000.

Senate Journal, 1842. *Extract from Report of* W. E. MORRIS, Engineer, dated Nov. 30, 1841.—Since the previous fall, the contractors have worked steadily, but with limited force, because of small appropriation from State. Expended at that date, $80,000.

Repeated recommendation in 1845, 1846, 1847 and 1848 for appropriation to complete the Western Reservoir, with remark that no funds are forthcoming.

Commissioners' Report of 1849 urges completion of Western Reservoir. Estimated to cost $45,000.

Commissioners' Report of 1850 refers to contract given out, but states that no work has been done because of disputes or back claims.

Report of 1851 states that the Reservoir was not completed.

Report of 1852 says as to Western Reservoir:—This work will be entirely finished in a very short period. It has been constructed in a most substantial manner, reflecting great credit upon the contractors and the officers having it in charge. To

prepare for the dry season, the sluice gates were closed in June last. By the latter part of August the water had accumulated to the depth of forty feet above the feeding pipes, which afford an ample supply to the canal during the period of low water, enabling boats to pass with full loads.

The appropriation of the last session will be sufficient to meet the whole cost of construction.

Report of 1853 says:—Very little interruption was experienced throughout the season, except from low water in the Conemaugh. The banks of the Western Reservoir being new, it was considered unsafe to fill it to its capacity. At no time did the depth of water exceed 50 ft., being 15 ft. less than its capacity. In consequence, owing to the long continued dry season, the reservoir was exhausted, and boats prevented for a short period from passing with full loads. The banks having now become settled, and the reservoir capable of holding with safety a depth of 65 ft. of water, it is believed that it will answer the purpose intended of furnishing a sufficient supply to the upper levels during ordinary dry seasons.

We have given in previous issues quotations from Mr. MORRIS' reports.

An Automatic Water Gate.

The automatic water gate here described would seem to possess many points in its favor, in the way of strength, durability, and cheapness, and should be adapted for use under many conditions.

Briefly described, the bed and sides of the sluiceway may be formed of timber, stone, or other material, and this sluiceway may be of any desirable width extending across the stream. At the down stream end of the bed is a roller (B' Fig. 1), journaled in suitable bearings, and to this roller is attached the gate proper (C), made of stout plank, well bolted and further strengthened by cross timbers on the under side. Back of this gate is another roller, B^2, journaled in like manner to the bed. The free end of the gate, C^1, is connected with the second roller by a jointed connection shown in Fig. 1, which is arranged to fold under the depressed gate, as shown in Fig. 2.

In a space between the main walls of the sluiceway a flume is formed, into which the water will freely flow from the up-stream side until it meets the stop-wall, A^5, shown in dotted lines in Fig. 1. At the base of the triangle, formed by the gate and its hinged back support, are two ports controlled by gates, with rods extending to the surface. The port above the stop wall is the feed port, and that below is the discharge port, and both are so placed as not to be uncovered when the gate is down. The valves to these ports are operated by a gear movement in such manner that as one is opened the other is closed.

When the gate is depressed, as shown in Fig. 2, the feed port, or upper one, is shut, and no water can pass in from the flume above; but the water beneath the gate can flow out through the lower port which is now open. To raise the gate the position of these valves is reversed by turning the hand-wheel. The hydraulic head to perform this work is obtained by the difference in level between the upper end of the flume and the feed-port, and is sufficient to force the gate up and hold it there as long as this upper port remains open. In closing the gate, this upward pressure is removed by the reversal of the port-valves, as before described, and the water, coming through a third port M, acts upon the hinged section and allows the gate to fall.

The gate C can be held at any desired elevation by adjusting the port-valves, or partially opening and closing them. There remains yet to be described the "idler section G^1, jointed by one end to the upper end of the gate C^1 and with its lower end resting on the bottom of the sluice-way. This "idler" moves with the gate to cover the folding section and to protect it against logs, ice, driftwood, etc., and for this purpose its lower end is armed with a chisel-pointed, metal toe to keep it always in close contact with the bed. Sand boxes, K, are attached to the idler to assist in keeping it down by their weight.

It should be further explained that the port M lies beneath the "idler" when this is down, and, being without a valve, is open at all times to preserve the equilibrium and prevent varying pressure on the two sides of the section.

This gate is in use at Menominee, Wis., and is strongly endorsed. It is especially recommended for lumbering dams of from 14 ft. to "300 ft. or more in width." The patent is controlled by the Parker Automatic Water Gate Co., of Menominee, Wis., which company will doubtless give any further information desired.

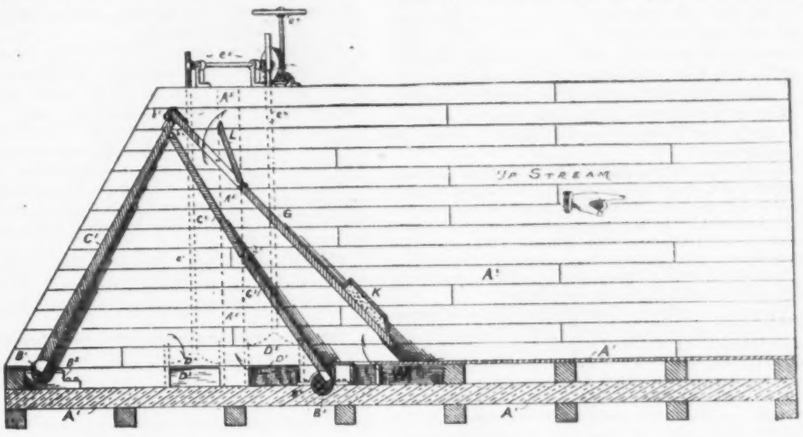


Fig. 1. Gate Closed.

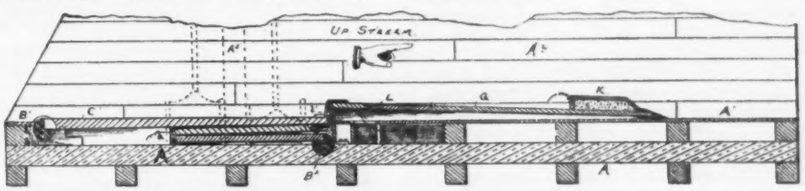


Fig. 2. Gate Open.

The Parker Automatic Water Gate.

American Freight Cars on English Railways.

An attempt to introduce the American type of freight car on British railways is being made by Mr. M. R. JEFFERDS, 79½ Gracechurch St., London. In a circular of which he sends us a copy, he calls attention to the high freight rates which now prevail throughout England, and explains why he believes this to be due to the use of the old-fashioned "freight wagons." He compares the freight rates on 30 tons of grain sent from Stirling, Scotland, to London, 420 miles, and from Chicago, Ill., 1,000 miles by rail and 3,500 miles by sea to London. In the first case, the cost is $281.45. For the journey of 4,500 miles the cost is $232.75, a difference of 17¼ per cent. in favor of Chicago.

Mr. JEFFERDS then goes on to give statistics tending to show the decline of British industries consequent upon these exorbitant rates of freight; and he makes out a pretty strong case. He then continues:

> There is no earthly excuse for this state of affairs except stubbornness or ignorance, either of which should relegate the perpetrators to their proper prehistoric spheres, and the type of rolling stock which they are using to museums of antiquity.
>
> It has been stated by the chairmen of some of the principal railways in Great Britain to their shareholders and the public, that in the matter of working expenses, they "have reached the minimum, and cannot now expect to make any further reduction."
>
> They claim that they are working their roads at 52.24 per cent. of their gross receipts, while the working expenses of the best railway in America (the Pennsylvania) are 63.26 per cent. of its gross receipts.
>
> Now let us analyze the facts, make a few comparisons, and see what basis they have for coming to this conclusion:—

	Working Expenses. English.	American.
Percentage of gross receipts	52.24	63.26
Average rate *charged* for transporting per ton mile (pence)	1.25	0.335
Average *cost* to the railways of moving per ton mile (pence)	0.653	0.202
Percentage of working expenses to gross receipts as they would be if the Pennsylvania Ry. Co. charged the same rates as are charged by the English railways	52.24	16.96

This shows very clearly a difference of 67¼ per cent. in favor of the American system of moving goods. It is stated, however, that the American system will not do for English railways. How does any one know that it will not do? It certainly has never been tried, but is being daily condemned by railway men who know nothing at all about it, and are too obstinate to learn.

The operating expenses of the railways of the United Kingdom were £33,000,000 in 1887, of which 67¼ per cent. or £22,275,000 can be saved annually by adopting modern rolling stock.

Suppose we have 240 tons of coal to send to London daily, what would be the difference in dead tonnage or tare between the English wagon and the standard American type of tube frame cars with bogie trucks, the axles of which are always at right angles with the rails upon any curve?

	English Wagons.	Tube Frame Cars.
Tons to be moved	240	240
Vehicles required	30	8
Number of wheels	120	64
Length of train, excluding engine	540 ft.	280 ft.
Weight of vehicle (tons)	150	76
Dead weight of train, cars returning empty (tons)	300	152
Movement of dead weight, or tare saved on each round trip, if employing the tube frame cars	.. .	148 tons

It will thus be seen that there is a saving to be made of the expense of moving 148 tons of dead weight, or tare, in the movement of every 240 tons of paying freight, vehicles returning empty.

The average cost of moving 1 ton 1 mile on the English railways, as shown above, is 0.653 d., but for this calculation, and to allow for all possible deductions for unmentionable charges, we will call it only 0.40d. per ton per mile 148 tons × 0.40d. = 59.20d. cost for every mile this 148 tons of superfluous dead weight or tare is moved.

According to the Board of Trade returns, there were, in round numbers, 270,000,000 tons of freight moved on the railways of the United Kingdom in the year 1887, therefore we have $\frac{270,000,000}{240} = 1,125,000$ trains × 59.20 d. = £666,000 × 30 (allowing that each train runs 30 miles) = £19,980,000 to be saved annually in the item of dead weight, or tare, alone, if the freight traffic were conducted in this ratio.

Mr. JEFFERDS makes a similar comparison between the cost of carrying 32 tons of stone from Bath to London, showing a difference of 33⅓ per cent. in saving of dead weight in favor of the American type of car. He then argues that under such an arrangement, if the railway company charged the same rate per ton per mile as now, it would amount to a reduction in freight rates of 33⅓ per cent. Its receipts would be far greater, for the reduction in rates would greatly stimulate shipments. Indeed, Mr. JEFFERDS declares that it would quadruple shipments; all of which, however, could be moved with no more motive power than that now on hand,

since the friction of the bogie truck car is so much smaller—a rather roseate view of the case. In discussing the argument that English railway rates must be high because the cost of construction of English permanent way is so high, he very neatly shows that this is no argument at all. "The more a road costs, the better it should be, and the more cheaply it should be worked, or why make the extra outlay?" Upon the Louisville & Nashville R. R., it costs only 0.313 of a penny per ton-mile to move freights, while in England, upon the best railways in the world, it costs more than ⅝ of a penny per ton per mile.

Do the railway managers know this? Most assuredly they do; but everything in the nature of improvements is referred by them to under officials, who know all about railways, "as how it was done afore," but look upon an innovation as upon a foreign language they have never studied—they do not understand it, and life is too short for them to learn anything new, therefore all innovations referred to them are rejected.

There are many objections raised against the American style of rolling stock for freight traffic in England, but none of them have any foundation in fact. It is too often the case that people give their opinion upon a subject that they know nothing whatever about.

The verdict against the modern type of rolling stock used in America comes from absolute ignorance of the subject, and as a general thing those who give the verdict are either too old or too stubborn to learn anything new. I have discussed this subject with very many of the railway officials, and after answering every objection made by them they have said, "Well, our people are too conservative to make changes," and one high railway official has gone so far as to say that he would not allow a Yankee thing on his railway anyhow.

Mr. JEFFERDS takes up the common objections to American cars on the ground of the cost of changing rolling stock, and on the ground that the cars are too long to be turned on the English turn-tables, and shows their frivolity. He also explains the disadvantage of the custom of delaying freight cars to furnish a temporary storehouse for the shipper, and in conclusion offers to build and lease to railway companies all the freight rolling stock they may require at a cost of 2 shillings per car per day. As many of the railways are now paying other roads 3 shillings per day rental or demurrage for cars, of one-fourth the capacity, the above rate is far from exorbitant.

For the sake of British shippers and holders of British railway stocks, it is to be hoped that Mr. JEFFERDS may have some success in overcoming the mountains of custom and prejudice which exist, and in introducing the American type of freight car abroad.

The Filter at the Portersville, Cal., Water-Works.

The water supply at Portersville, Cal., is pumped from an irrigating ditch, which for some distance above the pumping station passes through adobe soil. The water at some seasons contains much adobe sediment in suspension, and to remove this it is passed through a filter before going to the pumping well. The water first passes through a bank, or layer, of coarse gravel, then through a well into the filter proper, which is a box 3 by 5 ft. in section by 16 ft. long, containing alternate layers of gravel and charcoal, each about 2 ft. thick, the gravel being first graded in size, fine, then medium, and lastly, coarse. The pump-well is 10 ft. in diameter and 9 ft. deep, and the pump has a 10-in cylinder.

The filter was designed by E. NEWMAN, Superintendent of the Pioneer Land Co., which owns the works. Mr. NEWMAN wished to put in a better filtering plant, but was limited in his expenditures. The filter worked well at first, but soon became clogged with the adobe sediment. The flow of water through the gravel bed can be reversed, thus cleaning it, but there is no way provided to clean the filter proper, as it connects at one end with the pump well, towards which it slopes. A new filter has been proposed. We are indebted to Mr. NEWNAM for these facts.

THE QUEENSFERRY SPAN OF THE FORTH BRIDGE has been completed as far as the cantilever arms are concerned. The suspended span of 350 ft. is yet to be hoisted into place within the next three months. This span, with arched top-chord, will weigh about 800 tons.

The Morgan Rail Joint.

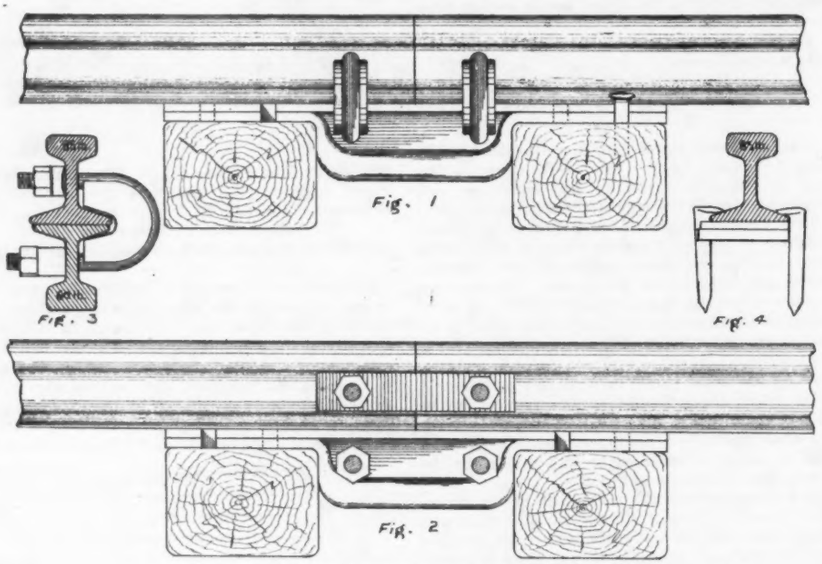
The Morgan rail joint, a recently perfected device, consists in placing underneath the abutting ends of the track rails of a railway track a sub rail, to give the joint direct support.

Suitable jaws are used for clamping the ends of the track rails to the sub-rail, by means of bolts that encircle the exterior of the jaws and pass through the webs of the track and sub-rail.

Fig. 1 is a side elevation view of the inside (flange side) of the track rails and sub-rails, also showing spiking slots, the jaw pieces and encircling bolts.

Fig. 2 is a similar view from the opposite, or outside, showing the track rails, sub-rail, the alignment bar, the ends of the encircling bolts, and the nuts.

The sub-rail is made by swaging down at the ends the heads of the pieces of old track rail, which are cut into suitable lengths, about twenty-seven inches, so that they will extend over the entire width of the tie on which they rest. The swaging of the sub-rail laterally expands it to such an extent at the ends that it is wider than the superposed rail, thus saving the wear upon the ties, especially if they are of soft timber, and also providing a margin outside of the rail base to enable the sub-rail to be firmly spiked to the cross ties. The abrupt shoulders of the sub-rail bear against the ties and in combination with the spiking are intended to prevent the track from "running" or "creeping."



The Morgan Rail Joint.

The upper surface of the sub-rail is a *straight edge*, on which the track rails are held in rigid contact by the clamps, so that the abutting ends of the track rails are at all times on the same plane. Whatever depression may take place, it is necessarily the same in each rail, and is common to the track generally, thus preserving the surface substantially as smooth at the joint as at any other part of the track.

The alignment bar shown in Fig. 2 maintains the rails vertically in perfect line with each other.

Scientific provision for the expansion and contraction of the track rails is made in the elliptical form of the inner surface of the jaws, which permits, without loss of tension, a slight rocking motion of those parts, as the ends of the track rails move to and fro by the change of temperature, thus securing separate action for each rail and avoiding any accumulation of force or movement.

Railway companies themselves can manufacture all the parts of this joint out of their worn track rails and old iron. Actual use under severe conditions since October, 1882, seems to have demonstrated the competency and excellence claimed for the joint.

A considerable mileage of this joint is now in use near Chicago on the Chicago, Burlington & Quincy Railroad. This company has purchased the right to use the joint on its system, and has a plant at Aurora for manufacturing them. MR. RICHARD P. MORGAN, of Dwight, Illinois, the inventor, claims a much less first cost than that of the standard of angle plates now in use, and also a great ultimate economy, consequent upon the indestructibility of the principal parts of the joint, and the provision made to evade the constant injury which all angle plate joints receive from the destructive force of the expanding and contracting track rails.

Notes on Timber Trestle Bridges for Railways.*

I have observed for a good many years that the ingenuity and skill of engineers have been directed to more pretentious structures than "mere trestle bridges," notwithstanding that on the newer roads, and especially in the South and West, they constitute the majority, and in many localities from three-quarters to seven-eighths of all railway structures. It is true it does not require much technical skill to design and construct an ordinary trestle, but good judgment is necessary here as elsewhere, and in practice, especially in the construction of high trestles, there is room for the exercise of good construction faculty. While it cannot be expected that engineers will agree upon a design for general use, there will be general concurrence as to the desirability of the adoption of standard plans of uniform capacity. For while each road provides for its own rolling-stock, it must also provide for that of other roads. Variation in designs will grow, not only from difference in training or experience of designers, but also from the variable quality of the material to which the designers are accustomed. In the South, where timber grows rapidly and is coarse-grained, I should design a trestle, especially the floor system, with heavier members than I would with the timber of Michigan or Wisconsin. Even the same latitudes sometimes show variations in quality that are difficult to account for, though soil, humidity, and other atmospheric conditions must affect it. Material for substructure is, however, generally easy to get. So also is that for the superstructure, if the manager or purchasing department can be induced to pay for it. Herein lies one of the crosses that practical bridge men have to bear, and the difficulty is being met by the adoption of plans that provide such an excess of timber as will compensate for defects in its quality. This again results in encouragement to dealers to dispose of their inferior timber to the railway companies, and it is a common experience of bridge superintendents to steer between Scylla and Charybdis—the purchasing department on one side furnishing cheap material, and the demand on the other being for a good bridge. On this road, how-

* Paper by C. PALMER, Engineer of Bridge and Building Department, Chicago & N. W. Ry., Escanaba, Mich. Read at the convention, Am. Soc. C. E., June 21.

ever (Chicago & Northwestern), this condition has been gradually changing until there is now practical accord in the demand for suitable timber.

I place little reliance on the estimated strength of timber. Experience teaches what it will bear, and is a safer guide. Quality is of prime importance. A bridge is only as good as its weakest member, and it costs as much in labor to put in poor timber as good. With the most careful inspection, there will be variations enough. A bridge will never be built that will realize the poet's dream of the "one hoss shay." There will still remain plenty of reasons why the completed structure should be frequently examined. The flexible parts of a bridge should be of ample strength. It would be bad practice to design a bridge with stringers that would answer the demand of nice calculation and yet deflect enough for an engine to feel the undulatory motion imparted to it by the alternation of stringers and rigid supports. With just the right speed, a bounding motion could be imparted to the engine sufficient to break the stringers. In a succession of trusses, this deflection is provided for by the camber. In a trestle, no such provision is made, though there is no reason it should not be. But in its absence, the stringers should be as rigid as possible, and to guard against defective timber each stringer should be composed of at least two members.

As to designs, they are about as numerous as the designers. I favor short bolsters under the stringers; ties 6 ins. apart in the clear, with guard rails notched on them. In high timber bents, the outside posts should batter 2½ or 3 ins. to 1 ft., and for lateral stability should be stayed every 16 ft. with 3 x 10-in. transverse and longitudinal girts. I like to put in lateral braces between the caps of high trestles; they help to preserve the line, besides stiffening the bridge. There should be no mortise and tenon work, but I believe that practice is now about obsolete. For pile trestles, there is fortunately plenty of cedar in upper Michigan, and only cedar piles for all lengths up to 35 ft. are used. They bear driving as well as pine, and last twice as long.

The Great Bear River Canal System in Utah.

The call for bids for construction of 12 miles of the Bear River canal in Utah, recently published in this journal, inaugurates one of the most extensive systems of irrigation works in the United States. 2,000 cu. ft. per second will be the capacity of the main canal, which is doubtless more in volume than the aggregate of all other irrigation canals and ditches throughout the Territory of Utah, and represents a greater quantity than the sum total of all the utilized water supply of Southern California from which more than $60,000,000 worth of property derives its chief value.

Bear river is the principal feeder of Great Salt Lake, and is the largest stream in the Arid Region, the Colorado river alone excepted. It enters the lake from the north after passing through a corner of Wyoming and Idaho. Its waters are used to some considerable extent in Wyoming, for irrigation, and two small canals have recently been taken out in Idaho; but the Mormons of Utah, although the oldest and most skillful irrigators in that section, have never had the courage to undertake to divert the river upon the great arid plains through which it passes, for the reason that it involved engineering problems and a cash outlay which were beyond their resources.

The canal heads at the upper end of the lowest cañon of Bear river—a cañon which lets the river pass through the Wahsatch range into the Salt Lake basin. The cañon proper is but about two miles long. Above it is Cache Valley, a large, populous, and fertile plain, through which the river meanders with a grade so slight that the channel is broad, deep, and unruffled by ripples. The normal high-water level of this reach of the stream was the governing level of the canal head. It could not be materially raised without flooding the farms of Cache Valley. To get the canal out on the top of the plains as quickly as possible, and avoid as much as possible of the steep side cutting on the bluffs bordering the river below the cañon, it was essential to maintain the canal at the highest feasible level through the cañon, and on as light a grade as could be used consistent with a reasonable amount of work. This grade is 2 ft. per mile for the first 4,000 ft., then 4 ft. per mile for 5,000 ft., then 2 ft. per mile for 5 miles, to the edge of the plain, where the grade is reduced to 1 ft. per mile, and the depth diminished from 10 to 6 ft., and the width increased.

The diverting dam will be a simple structure not over 3 or 4 ft. in height, 650 ft. long, founded on smooth bed rock. The bed of the canal will be excavated several feet lower than the bed of the river at the dam. Six thousand feet from the head, the canal is divided in two equal parts, each carrying 1000 cu. ft. per second. The east branch continues down the left bank of the river, through the cañon, along the bluffs, and out onto the plains, skirting the foot of the Wahsatch mountains for 56 miles to its terminus at Ogden. The west branch crosses Bear river at a narrow point in the cañon, in a flume 75 ft. high, reaches the plain in about the same distance as the east branch, crosses Malad river, and skirts along the foot of the Promontory range of mountains, terminating near Blue Creek station on the C. P. R. R., a distance of 26 miles. A central branch, terminating near Corinne, is also proposed. In addition to these main canals, a network of laterals will be necessary to effect the distribution, amounting to several hundred miles in the aggregate. On the main canal before the division is made there will be one tunnel in solid rock, 425 ft. long. This will be 24 ft. wide, and 11 ft. high at the sides. On the east branch there will be 6 and on the west branch 4 tunnels, all short, the aggregate of tunneling being 1200 ft. Throughout the cañon the channel will be cut in solid rock consisting of black limestone and marble and quartz. The tunnels on both east and west branches will be 15 ft. wide, and 11 ft. high on the sides, and will probably be plastered with cement. The most important structures on the line will be the crossing of Bear and Malad rivers on the west branch. The former will consist of 4 spans of 60 ft. and a central span of 50 ft. supporting the flume box. The entire structure, flume included, will be of iron supported on cylindrical iron piers filled with concrete. The Malad flume will require no span longer than 80 ft. This will also be of iron. The maximum height will be 85 ft. The two will cost about $1,000,000. Other lower flumes and all gates, drops and waste weirs will be made of wood.

The work for which bids are asked is that portion which it is desired to complete before winter. The following season the canals on the prairie will be completed. The area covered or commanded by the canals is over 300,000 acres, all of the most fertile sandy loam, phenomenally smooth, and naturally inclined just enough to render it easily irrigated.

The enterprise is being carried out by New York and Kansas City capitalists and will cost $1,500,000, not including laterals.

FRED MATHYAS, C. E., formerly of the D & R. G. Ry., is the engineer in charge, with headquarters at Ogden. Mr. JAS. D. SCHUYLER, of San Diego, Cal., is the consulting engineer. The principal promoter of the scheme, and the man whose genius and diplomacy rendered possible the delicate adjustment of affairs in such a way as not to antagonize the Mormon church, or arouse Gentile opposition, is Mr. JOHN R. BOTHWELL of New York. On account of his paternity of the enterprize it is locally designated the "*Bothwell Canal.*"

The London-Southwark Subway.

THE Southwark tunnel, under the Thames, is approaching completion. It runs from the Monument in the city of London, to the Swan in Southwark or in Clapham, a distance of about three miles. The tunnel is double; in two independent cylinders, 10¼ ft. each in diameter, placed side by side over the greater part of the way, but one tunnel over the other under the narrow approach street on the City side. The tunnel shell is made up of segments of cast-iron bolted together by internal flanges in lengths of 1 ft. 7 ins. In the longitudinal joints thin strips of pine are inserted and afterwards pointed with cement. The circular joints are made by tarred rope and cement, the segments being used in both cases as they come from the foundry without planing. The material penetrated is London clay with short lengths of gravel and sand heavily charged with water.

The tunnel was commenced in May, 1886, and is now nearly completed. The method of driving adopted was as follows: In an excavation at the bottom of the shaft a steel cylinder was set in position, 11 ft. 6 ins. in diameter and 6 ft. 6 ins. long. Segments of several rings of the permanent tunnel were next jointed and bolted up. Within the forward end of the steel ring, 6 ins. from the front end, is fixed a strong, cast-iron ring to which is fixed a strong plate forming the advance end of the shield, and through this plate is an opening 6 ft. high by 4½ ft. wide, through which the miners pass and the material is removed. Arrangement is made to close this aperture by strong planks in case of any sign of an irruption of water. Inside this plate and abutting against the cast-iron shield-ring are six hydraulic press cylinders with the heads of the rams reacting against the last ring of the completed tunnel.

In front of the shield is another cast-iron ring fitted with adjustable steel cutters, acting against the clay in connection with eight hard-wood wedges, about 2 ft. long, which are set at the discretion of the miners and simply abut against the front ring. In practice the miners cut away the clay in front and throw it back through the opening described, until enough clay is removed to allow the shield to be advanced the width of one tunnel ring, or 1 ft. 7 ins. But in the center an advance heading is made, 5x3 ft. in section and 8 ft. forward in the hard London clay, or only 2 to 3 ft. in shaky ground. The wooden wedges are then set and the shield pushed forward by the presses, when the cutters and the wedges break away the clay in lumps. The spoil is removed in small iron cars hauled by ponies.

As the shield leaves an opening a little larger than the tunnel rings, this outside space is filled with blue lias lime grout forced in under a pressure of about 30 lbs. per sq. inch. This grout is mixed in a cylindrical vessel provided internally with six mixing fans bolted on a central shaft turned by an outside crank. Compressed air is led to the top of the cylinder, with a cut-off valve on the inlet, and the grout is forced from a bottom outlet pipe—also provided with a valve—into a hose leading to the lining plates. In each tunnel segment holes are provided into which is passed the nozzle of the hose. The grout is first applied to the lower segments until it appears at the holes in the higher segments; the lower holes are then plugged and the nozzle shifted to the next hole above and so on until the top is reached. This grouting covers the outside of the iron plates and also tightly fills all joints, and at places where the segments have been removed for station enlargement this work is proven to be thoroughly well done.

The tunnel has been driven without a single case of cracks to buildings overhead. Some householders discovered cracks after the tunnel had passed and claimed damages therefor. But the engineer, unfortunately for them, had previous to the arrival of the tunnel carefully photographed every wall and building likely to be affected, and in each case was able thus to show that the cracks were old and not due to the tunnel at all. The engineer of the line is Mr. J. H. GREATHEAD, M. Inst., C. E., with Sir JOHN FOWLER as consulting engineer. The contractors are Messrs. WALTER SCOTT & CO.

The Electric Railway.

A lecture was given by Mr. GEORGE W. MANSFIELD, of the Thomson-Houston Electric Co., June 18, at the first meeting of the newly organized Thomson Scientific Club, of Lynn, Mass., on the subject of the electric railway, which is interesting as reviewing the history of electric progress and showing the exact present status of this rapidly growing business.

Until recently, no important factor in modern civilization has had a greater dearth of information recorded in relation to it, historically and practically, than that obtainable in regard to tramways and street railways. About the year 1680, vehicles were first run upon wooden stringers, and in 1780 or 1790 the first iron rails were introduced. Both proved failures at the time.

Electricity took its start at the beginning of this century. At the same time the introduction of the steam engine and of steam locomotion began, and cars were introduced drawn by horses. The Baltimore & Ohio Railroad, the first in the United States, was chartered in 1827 and was intended for opera-

tion by horses. Steam was substituted, 1828-30. About the same time the Davidson magnetic engine was invented, and worked as an experiment only, by means of chemical batteries. In 1840 DAVENPORT, of Vermont, produced a magnetic engine. In 1850 Dr. PAGE, of Salem, Mass., attempted an electric engine for car propulsion, obtained assistance from Congress, constructed an engine weighing 5 or 6 tons, and operated it by means of chemical batteries, at Washington. All attempts, however, to use the chemical battery for the source of power have failed. During all this period electric power lay dormant and the world saw the marvelous development of steam power, with which every one is familiar. Before this time, to travel from Boston to New York required a journey of four or five days. It is now accomplished in six hours. This country alone has constructed over 150,000 miles of steam railroads, and has built 12,000 miles in a single year.

The necessity of getting from one immediate locality to another has increased as the growth of cities has continued. To meet this need, steam has been again and again tried, but has failed. In 1860 the Gramme ring was invented, and this, in connection with the Siemen's armature, has enabled electricity to be generated in sufficient quantity and so cheaply as to make the succeeding improvements practically successful.

As soon as electric power became practicable, all the intelligence and genius of the civilized world, which before had been developing steam power, turned its attention to the new power, and began developing it in the direction of the most pressing wants. Lights were poor, gas dear and unsatisfactory. A better light was needed. Hence, from 1870 to 1880, all experiments were conducted with a view of utilizing the electric light, and with what a marvelous result! No quarter of the civilized globe is unsupplied with the electric light.

In 1832 the first horse railway was introduced, being a line from New York to Harlem. To-day there are 25,000 street cars in use, and 150,000 horses. In 1856 the first horse car was introduced in Boston, on a line from Cambridge to Bowdoin Sq. Since that date Boston alone has built 218 miles of track, and now employs 8,000 to 9,000 horses and 1,200 to 1,500 cars. There are 800 cars running every day. The West End Street Ry., of Boston, has become, by consolidation, the largest street railway in the world. It carries 110,000,000 passengers in a year, or twice the number of the entire population of the United States, and more than the number carried by the combined steam roads of the State, which was 89,000,000. In New York, the street railways carry 325,000,000 and this in addition to 180,000,000 carried by the elevated roads. The speaker predicted that single electric-power stations would be built, in the near future, producing 10,000 to 20,000 H. P., or enough to do all the lighting and transportation service of a city. In touching upon the supplying of the electric power, where wires must be used, it was said that the underground conduit was an absolute failure. Water, mud, and the débris from the street made the open conduit entirely impracticable, owing to short circuiting. The Boylston St. conduit, constructed at a cost of about $75,000, had been abandoned. The absolutely only successful method in use to-day was that of the overhead wire and single trolley system. The right has been granted in Boston to use this method throughout the city. One hundred and twenty-five cities have granted this right already.

As to cars and motors, it was said that no motor ever had to withstand such natural and mechanical difficulties as the street railway motor. Electricians had always considered that an electric motor ought to be kept dry, to be effective. But now it has got to be used under a car near the street level, where its use subjects it to unforeseen rough treatment. How to construct a motor to withstand such use, mechanically and electrically, is a new problem to be solved. Such motors are now under construction, and are to be capable of withstanding the test of a stream of water from a hose, and to operate perfectly under such a condition. To relieve the congestion of cities, due to the concentrating of population in the centers, some improved means of transportation or circulation must be supplied. Horses are expensive, and can operate but 5 or 6 hours out of the 24. The solution is in the use of the electric motor, operating for 24 hours a day, if required, to supply these needs. The Thomson-Houston Co. has 45 to 50 electric roads now either equipped or under contract, while, it has been recently stated, 1,000 cars are now being equipped in this country, for electric power. The largest street railway system in the world is now considering the question of equipping its entire plant with the electric power. When one such line has completed its adoption, there will be an avalanche of roads hastening to follow. The electric motor, like the electric light, has met the needs of the world and has been approved. The inventive talent and brains of the country are to-day largely, if not principally, turned in the direction of the development of electric power. By means of electricity, in a quantity too small yet to be measured by instruments, we can talk from Boston to Philadelphia, in a whisper, and be understood, and the voice even recognized. What the same agency will accomplish in transportation and in the endless application of the useful arts, while not more wonderful, cannot be imagined, but it will work out results in accordance with the conflicting conditions of practical life.

American Engineers in Europe.

(From our own Correspondent.)

The American Engineers left London on the 20th inst., and, through the courtesy of the railway and steamship companies, were transported through to Paris in a less than 11 hours. The run to Dover was made in 100 minutes, in a special train of saloon carriages drawn by two engines. The President of the Institution, Sir JOHN COODE, and numerous members of the committee accompanied the party to the new steamer *Empress*, moored against the outside of the famous pier. The run across the Channel was made in very little over an hour, without much sickness. At Calais the French delegates met the party and escorted us in a double-headed train to Paris, stopping at Arques to see the operation of the hydraulic lifts at Fontinettes. Here the canal boats were passed from one level to another, about 43 ft. apart; in five minutes after the two boats were in the pontoons. The general arrangement of this work is identical with that of the Canal du Centre, at Houdeng-Coegnies (Belgium), as illustrated in *Le Génie Civil*, Tome XIV, No. 10, Jan. 5, 1889, and hence need not be repeated here.

En passant, we may add that the same journal contains an illustrated description of M. HAAG'S project for providing rapid transit in Paris, and at the same time connecting all the railway terminals, by means of an arcade road through certain streets and private properties, which the company propose purchasing. The estimated cost may be placed at 500,000,000 francs for 24 kilometers, or about $7,000,000 per mile. The company expects to make from 10 to 15 per cent. on the investment. A fine exhibit of the project is to be found at the Exhibition, where models, plans, and estimates may be seen. Your correspondent has been kindly furnished with a brochure of data which he has not yet been able to digest for the benefit of your readers, and hence refers to *Le Génie Civil* for the present. But to return. On reaching Paris, the engineers were given a day to get their bearings, and on Saturday were entertained at a banquet by the French Society of Engineers on the Eiffel tower, at which Engineer Eiffel himself presided.

The admirable inset which you have already published gives one an inadequate conception of the magnitude and beauty of the structure. The great arches under the four legs, and the outer curves reaching to the upper stage, although actually made up of straight members intricately laced together, make this structure a thing of beauty. It is the *chef d'œuvre* of the Exhibition, both in conception and execution, and that is high praise, for the remaining structures are palatial and regal in their magnificence. They combine the highest artistic and structural skill. The frame of Machinery Hall, having a span of over 380 ft., rests upon single iron pivots at the foot of each principal truss, rising in a Gothic arch to the center pin at the ridge. The roof is of glass on iron purlins. We must, however, omit details.

The party was divided into groups for the purposes of inspecting objects of special interest. These included various parts of the Exhibition—the luminous fountains, the sewers of Paris, the sewage utilization farms at Gennevilliers, the Schcol of Mines, Hotel de Ville, Hotel des Invalides, Jardin des Plantes, the Ateliers of the Omnibus Company, and various public works, museums, and libraries, with receptions too numerous to mention. Many of these objects merit detailed descriptions, but we can only generalize. The party will be dissolved on Saturday by a reception to be given by the city to the joint societies of French and American engineers. This will terminate the official visit, but arrangements are about concluded for a trip to the mining regions of Germany by those interested, and your correspondent will improve an opportunity of visiting the harbor and ports of the North German and Holland coasts.

L. M. HAUPT.

PARIS, June 27, 1889.

Programme of the Reception of the American Engineers in Paris, June 20-26.

From a copy of the official "Reception Programme," as issued by the French Society of Civil Engineers in honor of the visit of their American brethren, and kindly sent us by Prof. L. M. HAUPT, we translate the following synopsis:

June 20. Arrival at Calais. Reception by a delegation of civil engineers, headed by MM. A. GOTTSCHALK and A. BRULL, past presidents, and V. COUTAMUI and P. JOUSSELIN, vice-presidents; E. PONTZEN was in this committee. Depart by a special train, furnished without cost by the Company of Railways of the North. Stop at Arques, near Saint Omer, to visit the hydraulic lifts of Fontinettes on the Canal Aire. These lifts replace locks on the canal. M. GRUSON, together with an engineer of the establishment Cail, that built the machines, will explain the working of the system.

June 21. Rest in Paris.

June 22. At 10 A. M. A general reunion at the Exposition in the room of the Society of Civil Engineers in the Machinery Hall. 10.15. Presentation of the members of the Society. 10.30. Depart for the Eiffel tower by a special train on the Decauville railway. 11 to 11.30. Ascend the tower to the upper platform. 12. Descend to the first platform. 12.30. Dinner in the restaurant Brébant (toasts). 2.30. Descend from the tower and divide in groups under the guidance of members of the Society. Then follows a list of seven groups, with the special objects to be visited.

Sunday, June 23. Rest, or visit the fountains of Versailles, or different interesting churches, as the Madeleine, St. Eustache, La Trinité, Notre Dame, St. Etienne du Mont.

June 24. *Visit A.* The sewers of Paris. 9 A. M. Rendezvous at the Place de la Madeleine; 9.15, descend; 11, leave the sewers at the Chatelet. *Visit B.* Rendezvous at the Chatelet and leave the sewers at the Madeleine. *Visit C.* The National Manufactory of Gobelin tapestry and the Pasteur Institute. *Visit D.* Not more than 25 persons can examine the National Observatory, the Pasteur Institute, and the National School of Mines. *Visit E.* Depart in a coach from the Madeleine and visit the shops, laboratory, and depots of the General Cab Co. of Paris and the Omnibus Company on boulevard Bourdon and rue Championnet. *Visit F.* Depart from the Chatelet in a coach, and visit same places as given in previous visit.

June 25. *Visit G.* The Exposition, with an examination of the plant connected with the luminous fountains. *Visit H.* To Gennevilliers to see the plant there for utilizing sewage. *Visit I.* To the Historical Museum of the city of Paris. *Visit J.* To the Conservatory of Arts and Measures. *Visit L.* To the Hotel des Invalides and tomb of Napoleon I. and the Museum of Artillery. *Visit M.* Jardin des Plantes, etc.

June 26. *Visit N.* Hotel de Ville. *Visit O.* To the Hotel de Cluny, with its collection of national antiquities. *Visit P.* To the National Library, with its collection of medals, manuscripts, engravings, etc. *Visit Q.* To the National Manufactory at Sèvres. *Visit R.* An excursion to the works of M. DECAUVILLE, at Petit-Bourg, where the Decauville railway plant is manufactured.

BROOKLYN, N. Y., according to the last report of Chief Engineer ROBERT VAN BUREN, is much in need of relief sewers, and he recommends the Greene Avenue plan at a cost of nearly $2,000,000.

The Model of the Earth at the Paris Exposition.

One of the novel and interesting exhibits at the Paris Exposition is a model of the earth accurately made to a scale of one millimetre to the kilometre, or the one-millionth part of its natural size. It is a sphere 12,732 m., or nearly 42 ft., in diameter, having painted on its surface all the detail of the earth's surface. This globe is built up on a skeleton of wrought-iron, with the outside surface covered with wood, to which are affixed the cardboard panels covered with hard varnish. This great work was conceived and elaborated by M. TH. VILLARD and M. CH. COTARD, and it was carried out by M. T. SEYRIG (engineer) and M. ALBERT TISSANDIER (architect). A twelve-sided iron and glass structure with a dome covers the globe; in this building an elevator lifts the visitor to a platform, near the top, and from this point he descends by a spiral gallery of almost imperceptible slope, which reaches the ground after a great many turns. Though the globe weighs nearly 13 tons, it can be easily rotated by a hand-wheel.

The surface is so great (525 sq. ft.) that very considerable detail can be shown, and large cities, like Paris, even show a few of the main thoroughfares. As an educational feature, it is especially useful in permitting the eye to more accurately estimate the relative position and size of seas and continents than is possible with any plane surface map. An exceedingly interesting series of statistical and geographical information is also painted on the panels, in the shape of the population of continents, cities, etc.; sections of the earth's crust; the comparative heights of mountains; lengths of rivers, railways, telegraph lines, etc.

In the matter of telegrams received per 100 of inhabitants, it seems that Australia comes first (250 per 100), and Belgium and Switzerland next with 150 and 100. The United States comes in with 90, Great Britain with 90, and Germany ends the list with 40.

The number of letters passing through the post-offices of the different countries per inhabitant is given as follows in *Engineering* in describing this globe:

Great Britain	40
Australia	35
Switzerland	30
Belgium	25
United States	20
Germany	20
Holland	20
France	17
Italy	7
Spain	6
Portugal	5
Japan	3
Russia	2

In the summary of ocean surface as compared with the land, we find that the five oceans cover 221,000,000 sq. miles, or 74.4 per cent of the earth's surface; while the five continents cover 52,500,000 sq. miles, or the remaining 26.6 per cent. of the total. As the highest mountain on the scale used would be only $\frac{1}{8}$ in. high, no attempt has been made to show these in relief, but they are shaded in the painting to appear in relief. The coloring of the oceans represents by its intensity the depth in five shades ranging from a pale to a dark blue. Steamer routes are shown by various colors for the different nations.

Artesian Wells in New Jersey.

Mr. GEORGE H. COOK, State Geologist of New Jersey, in his annual report for 1888 gives notes on the artesian wells of that State and the advances made in the year. He says the wells on the Atlantic coast, between Sandy Hook and Cape May, continue to yield good and wholesome water, and some very satisfactory wells have been sunk along the Delaware.

Some of the wells sunk in 1888 are reported as follows: At the Atlantic Highlands, one was driven on the shore and a flow of good water obtained. At Seabright, a Mr. PAUL has nine artesian wells, 6 of them down 125 ft. and yielding 35 galls. per minute each by pumping. One is a 6-in. pipe and the rest are 3 in., but all yield the same amount of water. Later, three more were sunk to 258 ft., and stopped in a fine white sand bearing fresh water of good quality. The yield from each is about 40 galls. per minute, at 5½ ft. above the surface. Mr. PAUL thinks he can get 100 galls. from each by pumping.

These wells are sunk much lower than those at Asbury Park, and the water is drawn from strata which have been found dry at most places. The strata passed through in boring were as follows:—Sand, 18 ft.; yellow clay, 5 to 6 ft.; lower marl-bed, 35 to 40 ft.; black clay, or mud, with sand, 35 to 40 ft.; at 258 ft. was a thick bed of fine white sand and water.

At Atlantic City a well has been bored 1,150 ft. and a good flow of water obtained. The report gives a detail of the strata penetrated, from the report of Mr. J. H. MOORE, who superintended the work. Down to a depth of 900 ft. the material consisted of alternating strata of sand, gravel, and clay seams. At 903 ft. green marl was struck and occurred frequently alternating with sand, sandy loam, and clay until at 1,108 ft. a dark, tough clay was found under which was the water.

An analysis of the water made by Messrs. AUSTIN and WILBER was as follows:—

* Gallon equals 58,318 grains.

	Grains per gall.
Total solids at 212° F.	64.336
Silica	0.236
Sesquioxide of iron and alumina	0.105
Lime	1.079
Magnesia	1.020
Potash	1.493
Soda	31.240
Sulphuric acid (SO3) in sulphates	2.636
Chlorine in chlorides	19.303
Total solids determined	57.112
Volatile constituents	7.224
	64.336
Temporary hardness, equivalent to calcium carbonate	3.809
Permanent hardness, " "	0.326
Oxygen required to oxidize organic matter	0.003
Color	none
Taste	none
Smell	none
Reaction	faintly alkaline.
General appearance	exceedingly clear and attractive.

A well bored 380 ft. deep at Sea Isle City furnishes a moderate supply of water through a 4-in. pipe. The water rises to within 11 ft. of the surface and furnishes 1,800 galls. per hour. A well at Sayreville, sunk in 1887 70 ft. through clay and sand and then into gneiss rock, has since been sunk 976 ft., with no water. Another well at the Communipaw Coal Co's. dock in Jersey City has been sunk 450 ft. with practically similar results. This latter well penetrated—water, 12 ft.; mud, 40 ft.; hard gravel, 3 ft.; mud down to rock, 17 ft.; soft micaceous rock, 20 ft.; harder rock with crevices and soft seams to 450 ft. The water found in the crevices was brackish.

The Cuba Reservoir.

The many rumors current respecting the size and safety of the old Genessee Valley Canal reservoir, at Cuba, N. Y., make the following notes interesting. They are abstracted from a letter of "H. D. C." to the Albany *Evening Post*, and the data are said to have been obtained from the office of the State Engineer, who is soon himself to make an examination of this storage reservoir:

The Cuba reservoir dam was commenced in 1851 for the purpose of storing water for the summit level of the Genessee Valley Canal. A plan dated 1851, in the office of State Engineer BOGART, shows the dam to have been designed as 51.6 ft. high, 9½ ft. thick at top and 240 ft. wide at the bottom. The dry slope was about 2 to 1, and the inside, or wet slope, was nearly 3 to 1. The spillway is remote from the dam and is described as only "31 ft. in breadth by 5 ft. below the crest of the dam," or an area of 155 sq. ft. This spillway is divided into sections, each controlled by a gate. There is also a well-built masonry culvert under the dam, 6 ft. wide by 8 ft. high, also controlled by a gate. It should be stated, however, that the official canal maps give the height of the dam as 65 ft. above the bottom of the creek.

The situation of the dam is given in this letter as follows:—It is on Oil Creek, about 12 or 14 miles above the village of Olean, and is about 72 ft. (not 782 ft. as reported) above the village. The original reservoir was a little lake among the hills. The nearest village to the dam is Cuba, and if the dam should by any mischance break, it would bear down upon this village with destructive force. But below Cuba the flood would spread out over a broader area and do proportionately less damage than if confined within high banks as were the South Fork and Conemaugh streams.

The Genessee canal was abandoned in 1882, but the reservoir is still held as State property as a part of the Erie canal system. The dam itself is under the control of the State Superintendent of Public Works.

It seems evident from all reports, including the present letter quoted, that the knowledge of the exact present status of this dam is limited. It is therefore very proper for the State Engineer to examine it critically and to report upon it in full. In the light of the Johnstown experience, the spillway is too small, and its safety depends very much upon the intelligence and fidelity of the gate-keeper, a very dangerous element in the proper maintenance of any earthen dam. The best practice demands that such spillways should be automatic, and free from any possible failure on the part of an attendant to do a prescribed duty.

Accident on a Tile Pipe Conduit.*

The water supply of the city of New London is drawn for a part of the way through a conduit of 24-in tile pipe with sleeve joints filled with cement, which is under a head of from 18½ to 22 ft.

On a Sunday in January, 1875, the supply suddenly ceased at about 9 A. M., and on investigation it was found that one side of a pipe had fallen out where the line was in embankment, and that the full capacity of the pipe was being discharged into a neighboring brook.

Men and tools were hurried to the spot, which was about five miles from the city, and after much labor in a storm of rain and snow a new length was rolled in, but to our great chagrin it was found to be too short by about three inches. As it was nearly dark and the city was without water, there was no time to go back five miles for the material to fill the gap, so the following method was resorted to: A buck saw and a very dull axe were borrowed from a neighboring farmhouse and a rail from a fence near by. The rail was sawed into short lengths and made into wedges which were driven into the gap close together entirely around the pipe. A plaster of enameled cloth smeared with white lead, fastened with rope, was covered over the wedges, and the water let on. The next day the joint was found to be tight and a sleeve filled with cement was covered over all. The whole has remained to this day.

This, while perhaps not a job that a mechanic or engineer would approve, served its purpose, and shows the virtue there is in a wooden plug.

In this connection, particularly for the benefit of those who have "mud pipe" to repair, I will state that a wooden plug, judiciously inserted, will often repair a leak more quickly than anything else, and I think it might be employed to make a joint on cast-iron pipe which would be difficult or impossible to run with lead.

THE SURVEYORS of the proposed railway down the Grand Cañon of the Colorado are having a difficult and perilous journey. The following description of recent adventures of the party is from the *Salt Lake Tribune*?

The Colorado River Railroad survey party arrived at Hite about one week ago. They got along very smooth with their work to the forks of the Green and Grand Rivers, where the Colorado proper commences and enters the terrible Cataract Cañon. When they entered the rough water in the Cataract Cañon, for 46 miles, they only made a mile or two a day. They lost three boats, a great deal of provisions, bedding, clothing, surveying and photographers' instruments, but no lives. The party was made up of some very good material, including prospectors, lawyers, newspaper men, "club" men, dudes, and the last "craft" in the fleet, the "Black Bess," was navigated by two gentlemen of Senegambian extraction. One of these, on being asked about the thrilling experience and glory of having descended the great cañon, shiveringly remarked: Looka heah, boss, I don't want no glory; I want ter live." A Denver news correspondent arrived with a hat on, a photographer was clad in that solitary garb worn by the Navajo in summer, and a "club" man's fine physique was adorned by his complexion only. They left for down the river, and at Tickaboo repaired their boats, and are now at work between that point and Lee's Ferry.

*By W. H. RICHARDS, Superintendent, New London, Conn., in *Journal* of New England Water-Works Association.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

National Electric Light Association.—A convention will be held at Niagara Falls, N. Y., Aug. 6, 7, 8. Secy., A. V. Garratt, 18 Cortlandt St., New York City.

New England Roadmasters' Association.—Annual meeting at Boston, Aug. 21. Secy., W. F. Ellis, Woonsocket, R. I.

Civil Engineers' Society of St. Paul, Minn.—Next meeting, Sept. 2. Secy., Geo. L. Wilson, City Hall.

Roadmasters' Association of America.—The annual convention will be held at Denver, Col., beginning Sept. 10 Secy., H. W. Reed, Waycross Ga.

Boston Society of Civil Engineers.—Next meeting, Sept. 18. Secy., S. E. Tinkham, City Hall.

IN glancing over our railway news columns in the volume just completed, we noticed the large number of official reports from Presidents, Chief Engineers, or Secretaries of various new railway enterprises, and concluded that a summary of them would be of interest. The results of our summary are, that during the first 6 months of 1889 there have been published in this journal official reports of the status of work on 108 different railways, projected or under survey or construction, having an aggregate extent of 10,910 miles.

A summary for the 18 months between Jan. 1, 1888, and July 1, 1889, shows published official reports in our columns during that time from 272 new railway enterprises, whose aggregate projected length was 30,650 miles.

This does not include the large number of reports received relative to the extension of the lines of old companies, or the reports of enterprises showing no progress; neither does it have any reference to the news obtained from our regular correspondents and from other than official sources, which we publish each week.

We do not present the above figures as having any practical bearing on the probabilities of railway construction in the near future. It is quite an easy and inexpensive proceeding to project a railway, secure a charter, and make a preliminary survey; and the above figures show that a good deal of this work is being done, although actual construction is making little progress compared with recent years. What the above figures do show is the value and importance of our railway news pages to all who are interested in railway building. For the descriptions of these enterprises, whose aggregate length is nearly one-fifth the total mileage of the United States, are not based on mere flying rumors, but are the written statements of the chief officials of the various companies, made to us over their signatures.

THE grave disaster of June 30th, on the New York, New Haven & Hartford Railroad, by which three persons lost their lives, and a number of others were seriously injured, arose from a cause which is much more frequent than outsiders have any idea of, and which it is exceedingly difficult effectually to check,—viz., taking chances as to spiking, in putting in new rails between trains. The difficulty is, that it is the rule rather than the exception for rails not to be fully spiked between trains, and that, if not over half the spikes are omitted, the chances of any accident resulting within a day or so (unless the spikes have time to get started) are too remote for consideration. While every foreman of long experience knows of cases in which remarkably few spikes suffice to carry trains over at slow speed, what he does not fully realize is how enormously greater are the chances of accident when the speed is high. The *Evening Post* rather sweepingly remarks that "nothing more discreditable in the management of a great railroad line has been brought to light for a long time" than this occurrence, which in a sense is partly true, since a road with so very heavy and fast a passenger traffic as the New York, New Haven & Hartford ought to take especial pains to ensure that strict and safe regulations are in force and are lived up to in regard to tampering with the rails between trains; but no doubt such regulations were in force, and there is nothing, in this particular instance at least, to show that they were not ordinarily strictly lived up to, since this accident seems to have arisen merely from the indiscretion of a section-boss, left with more than usual authority for one day owing to a temporary absence of the road-master, and doubtless feeling that ambition to make a good showing in a small matter which has led many a subordinate to serious risks, often with disastrous results. Otherwise there is little in the occurrence which can justly be regarded as an impeachment of the management. There are a dozen accidents a week reported in the daily press, of which this can with far more justice be alleged.

IT is plainly evident that the crucial test of the Interstate Railway Association is at hand The withdrawal of the Denver, Texas & Fort Worth was to be expected, and it is hardly of great importance. The great dangers which now threaten the Association arise from two obdurate roads, the Chicago, Burlington & Northern and the Chicago & Alton. The Chicago, Burlington & Northern was built for the express purpose of carrying through traffic between Chicago and St. Paul at a lower cost than any other road. The new lines via Sault Ste. Marie were built to carry traffic between St. Paul and the East cheaper than any other roads. The existence of either of these roads makes the situation bad enough for the Northwestern system. With each determined to outdo the other in cut rates, the only hope of relief seems to be in the purchase of the Chicago, Burlington & Northern by those who are most hurt by its competition. is not at all improbable that this is exactly what its managers most desire. As the matter now stands, the Burlington & Northern has put in force a "Commodity Tariff," whose effect is practically a 40 per cent. cut on rates from Chicago to St. Paul and all intermediate parts. The Chicago, St. Paul & Kansas City has met the cut, and this has brought about a general reduction on Missouri river rates. If the reduction should spread far enough to reach Chicago, Burlington & Quincy territory, there are not wanting people who would call it a striking instance of poetic justice.

Since the preceding paragraph was written, a report reaches us that the Chicago, Burlington & Quincy has finally concluded to take charge of the troublesome road for whose existence it alone is responsible, and that a contract to that effect has been closed. If this report proves well-founded, it will be somewhat amusing that this virtuous act should follow so closely the boomerang stroke just referred to.

THE troubles in the Northwest, grave as they are, are not nearly so threatening to the stability of the Association as is the Chicago & Alton trouble. There is every indication that the managers of this company have definitely adopted the policy of complete independence, and propose to put it in force as fast as possible. They have already made a sweeping reduction in the Kansas City—Chicago rates on live stock and packing house products and also in passenger rates, and other moves of still greater importance are to follow.

The reason for the Alton's action is not hard to find. It alone, of the important Chicago systems, remained quiescent two years ago and refused to make extensions into the new and productive territory west of the Missouri. Other companies built hundreds of miles of feeders to supply their main lines with traffic. The Alton expects a full share of the traffic east from Kansas City which other roads have collected in the region farther west. But with eight roads competing for this traffic, even one-eighth of the whole would be too small a share to enable the Alton to keep up its old-time dividends. Its managers therefore seem to have mapped out a policy which is unique in its character and whose results will be watched with closest interest. In the first place, the Alton has made itself very popular with the public. Its aggressive attitude with reference to the payment of ticket commissions has won for it the friendship of ticket sellers all over the country and also of the "scalping" fraternity. Its passenger service is undeniably good, and its reclining-chair coaches alone have made for it a host of friends. Then such moves as that for the resumption of fast train service between Chicago and Kansas City, a few months ago, are calculated to give the general public the impression that the Alton is an especially liberal and large-hearted corporation. Kansas City especially was delighted with this, as evidence that the Alton was her best friend.

EVEN in its connection with the "Gentlemen's Association," the Alton has curried favor, for it withheld its assent until it was no longer safe to withhold it; and since it has been a member, it has done more to threaten the stability of the Association than any other member. But its master-stroke of policy has only been revealed since its notice of withdrawal from the Association was given. It has started a fight for the breaking of bulk freight at Kansas City; that is to say, it demands that through rates between points west of Kansas City and St. Louis or Chicago shall in no case be less than the sum of the

locals, and that the systems having lines east and west of Kansas City shall reap no advantage over the roads terminating there. Of course this move is hailed with joy by Kansas City men. They would like nothing better than to make their town "the grand receiving and distributing center between the East and the West, the basing point for eastern and western rates, and the breakwater for eastern and western trade," as the Kansas City *Times* enthusiastically expresses it. A movement is in progress, therefore, to induce all Kansas City shippers to patronize the Alton and boycott all other roads, at least until they shall consent to break bulk at Kansas City. The Alton managers are doubtless counting also on the coöperation of the numerous other roads terminating at Kansas City, and expect to fight only the Atchison, the Rock Island, and the Missouri Pacific. But if the other roads terminating at Kansas City which are members of the Interstate Railway Association are wise, they will not lend too much aid to a move whose main object is the aggrandizement of one particular city at the expense of other points. Certainly the St. Paul and the Wabash are not so much in love with the Alton that they will take pains to aid its schemes. As for the Santa Fé and Rock Island, they have made enormous expenditures to secure their own line from Kansas prairies to a junction with the Eastern Trunk lines at Chicago; they are not likely to throw away this advantage and dump their freight at Kansas City, if they can help it.

THE *Evening Post* of June 26 published an abstract of nearly three pages, on the results of last year's work in over 100 colleges and universities, showing a fairly good rate of progress. A list of the year's endowments of 42 institutions showed an addition of $3,675,000 to their permanent funds. The total of such donations, including gifts to libraries and other like benefactions, can hardly be less than $5,000,000, a sum which seems less considerable, in fact rather paltry, when we consider that it is only about 8 cts. per inhabitant of the United States. The additions from other sources have been very great, however. Thus, Harvard does not figure at all in the list, yet its income-bearing funds have increased $330,180 during the year. The libraries of 131 colleges now number 3,307,005 volumes, the additions during the year to 75 libraries having been 100,005 volumes, or at the rate of nearly 5 per cent. for the libraries reported. To know whether or not this increase is what it should be, one should know whether or not Public Documents and other like volumes figured very largely in the additions. The percentage of increase certainly does not tend to convey the impression that there are many college libraries which make even a serious pretence of keeping up with the times; for there are few departments of knowledge in which the year's increase of valuable books is not over 5 per cent. of those before existing, so enormously rapid is the rate of publication in recent years.

IT would be of interest, if the statistics were complete enough, to determine from the records the number of new "civil engineers" that have been ground out by these colleges, but unfortunately this is impossible. Some of the most important engineering schools, like the Rensselaer Polytechnic, are not mentioned. Others, like the University of Michigan, report only the number of graduates in "literature, science, and art," or in "science" alone. On the other hand, there appear the names of a few institutions which are new to us as technical schools.

A few of the various colleges specifically reported as graduating "C. E's." are: Alabama State University, 2; California, 16 in "science;" Case School of Applied Science, Cleveland, O., 4; Cincinnati University, 1; Columbia College, 19, with 2 "Sanitary Engineers" and 14 "Engineers of Mines;" Cornell University, 14 C. E's., 13 M. E's., and 19 "Electrical Engineers" (this latter figure well illustrating the great prominence which electrical engineering is now assuming); Cumberland University, Tenn., 3; Harvard "B. S.," 1 (the Lawrence Scientific, School, once of much promise and prominence, having been allowed to fall into rather disgraceful decadence for so rich a college); Haverford College, Pa., 2 "Bachelors of Engineering;" Iowa State University, 2; Lafayette College, 6; Lehigh University, 16 with 14 M. E's., and 5 E. M's.; Minnesota State University, 1; Nebraska State University, 3; Ohio State University, 1, with 1 M. E. and 1 E. M.; University of Pennsylvania, 29 in "science," with 20 in "finance," whatever that may mean; Rutgers College, 2; Syracuse University, 2 "B. C. E.'s;" Swathmore College, 7, in engineering of all kinds; University of the City of New York, 4, with 1 "Master of Science," who deserves, we hope, his rather broad degree; University of the South, Sewanee, Tenn., 1; University of Virginia, 6; Washington and Lee University, 2; Western University of Pennsylvania, 1; Yale College, 73 in all, from the Sheffield Scientific School, etc. As further evidence of the increasing prominence of electrical engineering, it is stated that there are now well-equipped special courses for its study in Columbia, Cornell, Princeton, Lafayette, Lehigh, Tulare, University of Michigan, and the Case School of Applied Science.

IN reading over such a list as the above, the absurdity of conferring the degree of "C. E." upon boys who have merely completed a course of general study tending to fit them to become engineers, but who are as yet unfit to assume the smallest professional responsibility, is very apparent to engineers if it be not to college faculties. The better way would be to give some general degree, like "Bachelor of Engineering," leaving the degrees of C. E., M. E., E. M., etc., to be granted only on conditions similar to those fixed for admission to full membership in the engineering societies. Thus the scandal and absurdity of a self-evident parchment lie would be avoided, and, what is more to the purpose, engineers devoting themselves to the study and practice of different branches of engineering would get each his appropriate degree. It may be said that the degree of "C. E." is ordinarily as well deserved on graduation as is that of "M. D.," which in a measure is true; but in the first place, in no other country is the degree of "M. D." so freely bestowed, the majority of the young practitioners of England, for example, being plain "Mr." only; in the second place, the newly fledged "M. D." is more nearly a physician in fact than is the new "C. E." an engineer, since he has seen much more of the practical side of his profession before graduation; and in the third place, the young M. D., who looks wholly to the general public for his future, needs the degree as a tacit guarantee of good faith to the public, while the young C. E., who for the first few years after graduation is wholly dependent on his professional elders for engagements, does not need it and is not helped, but rather hindered by it, since its ungrounded pretensions make it a subject of ridicule, which in part may extend to or prejudice its innocent bearer.

If a little more vitality and public spirit could be instilled into the administration of the American Society of Civil Engineers, and it would make an effort to effect an agreement among the different colleges to confer some preliminary degree like that of "Bachelor of Engineering," giving the degree of "C. E." only after a certain number of years of the practice of engineering, this end would probably be gained without great difficulty and with substantial gain to all concerned.

THE late resignation of ROBERT VAN BUREN, City Engineer of Brooklyn, was due, in great part at least, to the fact that he did not have the selection of his own assistants. It seems that the Civil Service Board of that city insisted upon providing him with such men as its members in their wisdom saw fit to recommend. As we have lately remarked concerning the complications arising from a similar issue between the Washington Civil Service and the officers of the National Surveys, this is one of the cases where one man is by no means as good as another so far as the public service is concerned. Engineering, of all professions and occupations, is the one least likely to be benefited by the application of the modern civil service system, especially as it is usually interpreted in dividing up city offices or "places." A chief engineer who understands his business, and has held his position for years, as was the case with Mr. VAN BUREN, is better able than any Board to select the assistants upon whom he must greatly rely, and for the integrity and intelligence of whom he is directly responsible. Such a chief already applies the true principles of civil service in retaining in his employ only the faithful and trained men, and in advancing the better material to higher office as their general experience may warrant, simply because it is to his interest and to the interest of the city he represents so to do. It is very possible that among these men preferred by him for a special service there may be some who cannot give the exact source of the Nile, or cover themselves with glory in firing off set pieces of mathematical fireworks; but the chief knows them and knows that for a certain service they may be implicitly relied upon; and this reliability is far better than familiarity with African geographical conundrums or mathematical gymnastics, as far as the good conduct of the affairs of the city of Brooklyn is concerned, for example. The observations upon this head given by Mr. VAN BUREN in the conclusion of his late report are so significant, and apply so well to many other municipalities than the one he serves, that we give them in full, as follows:—

> This bureau has had an unusual amount of work during the past year or so. The important public works proposed to be done give us greater responsibilities and considerable increase in detail work in the preparation of plans, etc. In important and difficult construction, where the engineer must be held responsible, it would be advantageous to let him have the right to name the principal men who are to assist in constructing what he has approved in plan. The public service will never be improved by taking away from the Chief Engineer the selection of his professional staff and important inspectors. The engineer of this bureau should certainly be the best judge of the special qualification needed in the inspectors for a piece of work designed here, and yet I have no voice in the selection at all. The best men in our employ to-day on construction are those selected by the engineer and held over for the past ten or twenty years. First-class mechanics are in demand: they do not seek employment with us,—we have to seek them. I hope the Civil Service Board will make a regulation that will give the Chief Engineer the right to select special men when the character of the work demands it.

AT last the advisability of a subway for subsurface works in Broadway is being at least unofficially discussed by the authorities of

this city. Commissioner of Public Works GILROY, in a late interview, after going over the familiar but disgraceful state of affairs on the city's main highway, says that a subway to hold the sewers, water, gas and steam pipes and pneumatic tubes, electrical cables, etc., is the only solution to the problem. He says, as we have often said before, that while the cost of such an improvement would be great, this method of disposing of these troublesome street fixtures would result in a constant and large saving forever afterwards. Mayor GRANT says the city has not now the requisite power to perform this work, but the Legislature can grant this power. The Mayor thinks that the city of New York has now attained a growth and character which demand that its public improvements, on the main thoroughfare at least, should be constructed on a permanent basis, and that a subway should be built under Broadway before that street receives its much-needed new pavement.

THIS expression of feeling on the part of the chief magistrate of the city and the head of the Board of Public Works is encouraging. We should now like to see them push the matter still further by appointing a commission of first-class and thoroughly disinterested engineers to fully investigate the questions of best methods and probably cost. No wise man builds without first making at least a shrewd guess at what he is going to build and how much he is going to expend in doing it, and the more carefully he considers this preliminary of plan and estimate of cost, the wiser he will be. As municipal work is much more intricate in design, conflicting in interests, and greater in aggregate cost than any individual effort, this preliminary investigation is of vital importance, and without it no safe progress can be made towards any important end. Let Mayor GRANT, now that he is personally convinced of the merits of the project, go one step further, and with his accustomed vigor attach dimensions and dollars and cents to what must be as yet only a general scheme without form or substance. He would have the support of every good citizen of New York in pushing this work to a successful issue, and in so doing would erect a monument to keep his name before a grateful public for generations to come.

THE recent disastrous conflagrations at Seattle and Ellensburg, Washington Territory, should teach a lesson to inhabitants of that section, in carrying on the present healthy and very active boom. The country is covered with forests containing an abundance of splendid timber, and owing to the great demand for new buildings, the temptation is strong to rush up structures of very considerable size entirely of wood, even in the thickly settled portions of the city. When a fire once gets beyond control in such a district, the efforts of the most effective fire department can do but little to check the flames. They spread in all directions, beyond the reach of the few streams of water which can be brought to bear upon them, and the fierce heat often compels the firemen to give up the task altogether.

Cities like Seattle, therefore, should b cautious about permitting many inflammable structures to crowd into the business sections, and the use of stone, brick, and iron as building materials should be encouraged in every way possible, even though the temptation may be strong to rush the building boom by countenancing the construction of very cheap types of structures. It is greatly to be desired, also, that the rapidly growing cities in this region of wooden buildings, should be supplied at an early date with an efficient water supply for fire protection, and that the extension of mains and supply capacity should at least keep pace with the growth of the city. In the rapid advance which many of these cities are making, the vital matter of fire protection is apt to be too long postponed, or at least to receive too little attention. It is to be hoped that the recent severe losses will serve as a salutary warning.

A Cheap Way to Widen Streets.

One of the most expensive public improvements which cities undertake is apt to be the widening of old streets, laid out before their future importance was at all realized. New York has a number of such streets, as have most of our Eastern cities. Perhaps no one on the continent is more urgently in need of widening than Nassau St., a short, narrow street, parallel with Broadway, running from Wall St. to Park Row, and now filling up with office buildings. It will, at all events, serve as an illustration, though Park Row itself and many other streets are in equal need of relief, and in many other such streets, in the heart of the business or office section of large cities, the great need is rather sidewalk room than roadway room. The most casual glance at Nassau St. suggests a method of increasing its sidewalk room, at comparatively small expense, which attracts singularly little attention, yet which would be quite as practically effective, on that street at least, as an actual widening costing millions, viz., a complete removal of the excrescences on buildings, and numerous other obstructions, which have kept each other in countenance in encroaching more and more on the narrow sidewalk, until now there is at certain points barely three feet of clear sidewalk space where there is fully eight feet of space between the curb-line and the building-line.

There are at least eleven different kinds of such excrescences, each of which, with some exceptions, has now acquired a vested right to exist, which cannot be taken away without compensation and which no man can be expected to give up unless his neighbors do so likewise; nor would it serve the purpose for an individual to act in the matter: such a movement, to be effective, must be general. Neither can it be expected that such a clearance can be effected by mere mutual agreement, because, since these obstacles to travel have been allowed to establish themselves by arbitrary individual action, unchecked by public supervision, some individuals have encroached much more than others, and, having appropriated more, have more to surrender. The net effect, however, is to greatly injure the property on the street by making progress along it so difficult that its otherwise natural destiny, to fill up with large office buildings, is made practically impossible.

To see how easily these obstructions may be removed by proceedings in the nature of a street opening which yet involve no other expenditure than the settlement of a kind of clearing-house balance of gain and loss between the owners, let us consider the nature of these instructions:

There are, first, and among the worst, the obstructions along the curb, consisting of (1) hydrants, (2) telegraph poles, (3) letter-boxes, and (4) lamp-posts. The telegraph poles we need not consider; they are likely soon to be removed, and may be summarily ordered out at any time as a nuisance (which they unquestionably are) without compensation to any one. If the wires cannot at once be placed underground, they can at least be carried over the roofs of the houses. The lamp-posts can be disposed of with equal readiness. Boston, which had special necessity to do so, early discovered how to avoid this obstruction to narrow streets by inventing a light iron bracket, projecting from the face of the buildings, or diagonally from the corner buildings, carrying the street light above the heads of the passers-by, without in the least obstructing the passage-way. New York, and several others of our cities, have been singularly neglectful of this easy possibility in narrow streets, and on Nassau St., fully a foot of the narrow walk is made useless at frequent intervals by these lamp-posts, such intermittent obstructions having nearly as bad an effect as if they were continuous. Letter-boxes occupy six or eight inches more of the availing space, projecting as they do squarely from the face of the posts, an arrangement which can only have resulted from the silent teaching of evil example, since it would really have been quite as easy to attach the letter-boxes endwise to the posts, thus avoiding unnecessary encroachment.

The hydrants may also be readily and completely eliminated as a street obstruction, if we profit by another Boston example, which places them wholly beneath the sidewalk surface, with an adjacent sign to indicate their position in case of deep snow. But if this appear too violent a change from local custom, they can at least be placed either on the less crowded side-streets or in recesses condemned and paid for within the buildings. In the particular street we have been using as an example, at least, as also in the still more crowded Park Row, the majority of the buildings are not so valuable or so well built that such provision could not easily be made by some slight alteration, without sensibly injuring their appearance.

These measures would clear the curb-line, and this alone would effect a great improvement. Of the interior obstructions there are, first and greatest, both on Nassau St. and Park Row, the huckster stalls, the thought of which gives one a discouraged sense of the uselessness of any such suggestions as these; for if property-owners do not care enough about their own property to insist on the removal of such nuisances, which it would cost them nothing but effort to get rid of, what chance is there that they will combine to effect improvements which must of necessity entail expense? Every one of those hucksters of unhealthy pies and papers holds his position by virtue of a city license to occupy free of rent ground which is urgently needed for the legitimate purposes of a public thoroughfare, and he is enabled to get the license, in most cases, through consent of the abutting owner, to whom he pays a regular rent; i. e., the lot owner is allowed to rent what is not his own to the serious detriment of its real owner, the public.

The remaining obstructions, and the only ones which are really entitled to public respect as existing by virtue of vested right, may be listed thus, the numbers being continued from the five distinct obstructions already enumerated.

(6) Projecting steps for entering the building on a floor above the street level, sometimes extending out over three feet.

(7 Projecting railings to guard sunken steps for entering the basement from the sidewalk, usually extending out three to four feet.

(8) Projecting show windows, consisting of glass and sash only, usually projecting out a foot or more.

(9) Projecting signs and images, sometimes extending out a yard or more.

(10) Raised steps extending along the entire front of the building, usually from 4 to 8 ins. above it, but sometimes even less throughout, and apparently added in the very wantonness of negligence, since they do little good and some harm even to the owners and tenants of the building.

(11) Ornamental projecting portals to a few large buildings.

The first two of the above obstructions, (6) and (7), may be admitted to be somewhat difficult to deal with, since they cannot be eliminated without considerable decrease of the floor space to be rented, and loss of architectural effect, for which compensation would have to be allowed. Nevertheless, they can in all cases be eliminated, with trifling alterations in the woodwork and masonry, by throwing the steps wholly within the building line. It is probable, however, that the diminished floor space remaining (it would only be a small percentage less) would in all cases rent for more than before, and when the building came to be rebuilt, the whole difficulty could be avoided by a slight change of floor level. The same is equally true of the long continuous-step obstructions, numbered (10).

The loss of the right to projecting show windows and signs would undoubtedly be a serious one to all store property. It is a privilege valued by retail dealers, and to retain it, it might be necessary to resign the foot next to the building line to the use of this and other obstructions. A still better and inexpensive remedy, however, might be found in a modest imitation of the law which is said to have once obtained in Constantinople: The streets of that city being very narrow, and concerted action for any public improvement being even more difficult to secure there than here, if that be possible, it was finally ordered by the Sultan that whenever a building was destroyed by fire, it should be set back ten feet, or thereabouts. Fires being of frequent occurrence, and the Sultan or his advisers not having considered the possibility that one building might be burned down two or three times before some of its neighbors had burned at all, the result within a few years was that the streets had a decidedly straggling appearance and were at points much wider than the lots, while the effective width of the streets was hardly at all increased. We give the facts of this interesting case only from memory, and we may err somewhat in the details, but we believe the substance of it is historical.

So radical a procedure is not likely to do much good anywhere, but it is not easy to see why a modification of the order, requiring that the street line should be moved back once only, and then for a moderate distance, in case of fire or rebuilding, with suitable arrangements for compensation for the land surrendered when it was surrendered, might not effect a very good result in such a street as Nassau St., which is likely to be entirely rebuilt within a decade or two, but where it would involve quite unnecessary expense and inconvenience to tear down the fronts all at once. In this way the difficulty as to projecting signs and show-windows might be got over by a merely temporary surrender of the privilege, or temporary surrender of a foot of sidewalk width.

This leaves only one class of obstructions remaining unprovided for, No. 11, the massive projecting portals of a few large office buildings, all of very recent construction, which have naturally enough been carried out in almost every instance, beyond the building line proper, to what we may call the "obstruction line," although this "line" is very ragged and ill-defined, having no exact relation to the building line. The very fact that these obstructions are as yet so few, and also likely to rapidly increase, should compel early attention to the needs of the case, and would, if there were less politics and more wisdom in our city administration.

The property owners would naturally insist that if such an improvement were to be attempted at all, it should be applied with equal stringency to all buildings, and in most of the large buildings on the particular street we have used as a text, this could be effected at moderate expense, without serious architectural injury. If this were found impossible, there would still be the two alternatives of doing the injury and paying the bill for it, or leaving the improvement still incomplete as respects such buildings only. This would not seriously matter, if not excessive at two or three points only on a long street, while it would seriously matter if it were to occur in every second or third building.

The extent of the injury done to property on down-town streets like Nassau St. from narrow sidewalks seems to be very inadequately appreciated by the owners of this property, or they would not be so indifferent to it. It has only become the great evil it is within recent years, with the introduction of elevators and high office buildings. Every such building means a throng of people on the sidewalks about it. There are said to be 40,000 people a day entering the new Equitable Life Insurance building alone, for example, and its daily inhabitants number 1500 or more. To make even one such building possible, the offices must be readily rentable; to be readily rentable, they must be conveniently accessible; to be conveniently accessible, there must be ample sidewalk space for even one such building, and *there must be other like buildings all around*, so that it may not be too long a walk between offices. If, then, even one such building needs ample sidewalk space, how much more is it needed in a whole street of them? And without a whole street of them, or the prospect of their erection, not even one may be built. The probable effect of these differences of condition upon real estate valuations is too plain to need further discussion.

CORRESPONDENCE.

New Railway Enterprises and Irresponsible Promoters.

NATCHEZ, MISS., July 3, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

I notice a communication from a correspondent from Natchez, Miss., in the ENGINEERING NEWS of June 22, in which he speaks very disparagingly of a railroad enterprise in this part of the country, warning you of a certain party connected with it, and also stating that he himself together with other engineers have not been paid for what work they have done. The natural conclusion to be drawn from that article is that he has reference to the New Orleans, Natchez & Fort Scott Ry., from the fact that this is the only projected road in this part of the country that has lately had engineers in the field. You will readily perceive what damage such an inference may work to a new enterprise like ours. I may here state that we have had a full corps of engineers in the field continuously since last November, and have paid them regularly every dollar that has been due them, and there has never been any complaint made on that point, at least not to us.

I would request you to furnish me the name of the party referred to in the communication, as well as the name of the correspondent, in order that we may have an opportunity to place ourselves in a proper light before the public. I think it is nothing more than due us, and have no doubt that you will sustain the proverbial reputation for justice that the NEWS enjoys among the engineers of the country by complying with the above request.

Yours very respectfully,

C. W. ROEHRIG,
Asst. Eng'r New Orleans, Natchez & Ft. Scott Ry.

[We must decline to give the names which our correspondent requests; but in order that no injustice may be done, either to his enterprise or others in its vicinity, we will say that the enterprise referred to by our Natchez correspondent in ENGINEERING NEWS of June 22, has no mileage in the States of Mississippi or Arkansas, and has no connection with the New Orleans, Natchez & Ft. Scott road, nor with any road centering at Natchez.

We definitely stated our position in regard to reports of new railway enterprises in the editorial note accompanying the letter above referred to. Necessarily, in publishing descriptions of hundreds of enterprises every year, we cannot vouch for the authenticity of the statements made by our many correspondents, although we shall not knowingly publish misrepresentations. At the same time, this journal represents the interest of engineers and capitalists as well as that of railway projectors. If any responsible man wishes to make over his own signature any statement of general interest concerning the unfavorable prospects of any enterprise or the unreliability of its promoters, our columns are open to him. We are glad, indeed, to receive such information even when the informant does not wish his name to be published, on account of its usefulness in making up our records of work in prospect. For obvious reasons, however, we cannot generally publish such information unless the party furnishing it is willing to hold himself responsible for its accuracy and permits us, therefore, to publish his name.—ED. ENG. NEWS.]

A Day's Long Run with a Transit.

Union Pacific Railway Company,
OGDEN, UTAH, June 18, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

We have frequently heard of long runs made in a single day upon railway surveys, but considering the time occupied, the following is believed to stand well in comparison:

On May 23, 1889, a Union Pacific railway party, in average working order, made 20 miles complete, including the levels, in 9 hours and 14 minutes, while crossing the Great American desert, southwest of Salt Lake. A 200-ft. chain was used and all stakes lined by transit.

The level man used two rodmen, the work being thoroughly done, the bench-mark opposite the twentieth mile being set before the transit hub was centered.

The intention was to have completed 30 miles during the day, as the water supply was getting low, but owing to the teams becoming mired in a salt slough early in the afternoon, work was suspended soon after and camp made for the night, otherwise 30 miles would have been run.

Other similar runs were made, but the day in question was about the only one in which 30 miles or more were obtainable without the delay consequent upon topographical considerations. But for the time occupied the writer has never heard of a better run, where all the instrumental work was completely done.

The party was in charge of Mr. M. E. NUTTING, with H. H. HOLLIDGE as transitman, and C. W. SWEARINGEN, levelman. There was also an excellent crew of assistants, in which crew the "tenderfoot" was conspicuous by his absence.

Yours truly,

J. Q. BARLOW, *Div. Eng.*

Strength of Beams and Columns.

NEW HAVEN, CONN., May 28, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

A book has recently been issued on the "Strength Beams and Columns" by E. and F. N. SPON, bearing on its title-page the name of ROBERT H. COUSINS, and containing among its first principles a few statements to which I would like to call your attention.

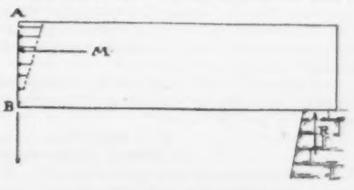


Diagram of Bending Stresses.

The first chapter introduces a discussion of the moments and resultants of uniformly varying forces distributed over rectangular or circular areas, and Chapter II reaches the question at issue, namely, the position of the neutral axis.

On page 22 is correctly stated the law of compression and tension in a beam. Both strains must decrease

from the surface towards a common point within the beam, where both strains become zero in intensity and they may be classed as *uniformly varying* forces."

Then in the next paragraph he states for the plane of rupture: "No line in this plane has any of the properties of an axis that are usually assigned to it by writers on this subject." This is pure assumption, and it can be shown analytically that if his fibre strains vary uniformly, the line of zero strain *will* be an axis through the center of gravity. If he admits that the strains vary by some other law, he may well have a neutral axis of rupture distinct from the neutral axis within the elastic limit—not otherwise.

His idea on page 25 that "as the load is applied, the compressive and tensile strain penetrates the beam from the top and bottom respectively" is decidedly crude, especially when he adds: "Theoretically we know that they must meet at a common point within the beam at the moment of rupture."

Theoretically we know that fiber strains increase from zero at the neutral axis to a maximum at the surface.

Turning another page we are startled by a statement which scarcely calls for comment. It runs as follows: "At the *instant* of deflection the *bending moment* of the applied load is held in equilibrium by a *purely* compressive resistance" which varies "*uniformly*" and is "zero in intensity at the bottom or extended side of the beam." (Italics throughout are his.)

I take it that for equilibrium Mr. COUSINS will admit:—

(1) The moments of our forces about any point must be zero.

(2) The resultant of our forces in any direction must be zero.

Let us take a section of his beam *A B* with simply compressive forces in action. We can substitute for these forces in the beam fibers some force that will replace them in direction and magnitude. Let *M* be their resultant and *A* the center of moments, as in his book, and let us grant that condition (1) is fulfilled for any point as *A* and also that (2) is satisfied for vertical forces. How about the horizontal? The couple *R* and *W* must be balanced by another couple, and as things stand, the beam will slide in the direction of the arrow *M*.

In his "Summary of the Theory" on pages 31-32, paragraph 8 offers a further and careful extension of the error illustrated in our figure by stating that "the algebraic sum of the direct forces of compression and extension can never become zero."

A book based on such fundamental misconceptions is not only worthless, but calculated in the hands of a beginner to do positive harm.

Very truly yours,
FRANK D. LEFFINGWELL.

The Flood at Johnstown.

Pennsylvania R. R. Co.,
MINERAL POINT, June 25, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In glancing over your valuable record of the flood in the Conemaugh, I think you are mistaken in the time that it took the flood to get from the dam at South Fork to Johnstown. You have it 20 minutes from the break until the am at Johnston bridge occurred.

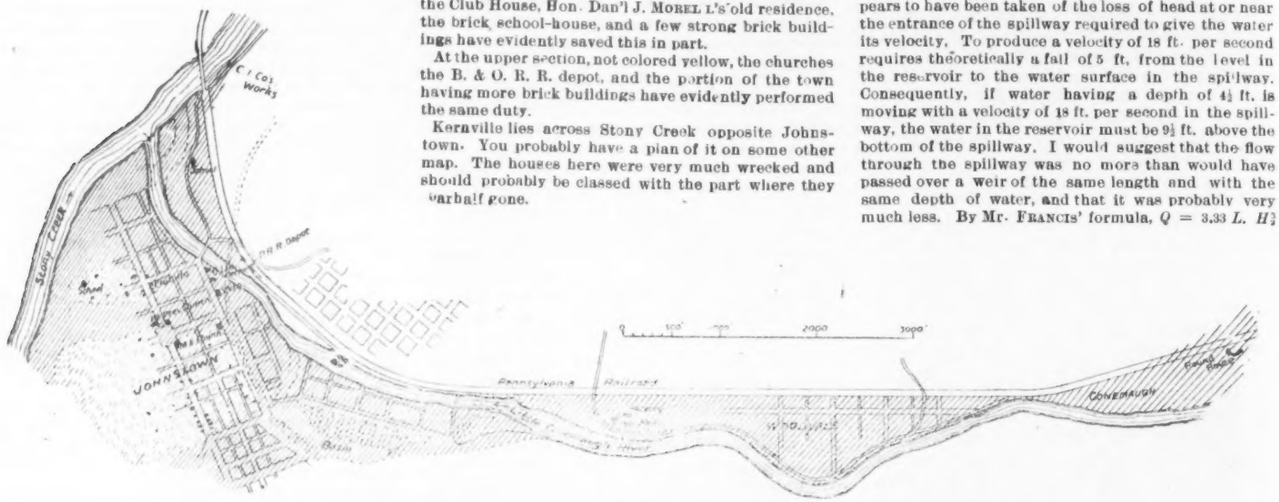
Our railroad men who were along the line, and the telegraphic communication from one point to the other which was going on at the time, give me the information that it was about one hour; the dam breaking at 3.07 and the flood reaching Johnstown a few minutes after four. There is such a wide difference that I think proper to send you this, as I know you are doing a good work in preserving the record.

I would further send you the enclosed sketch which I made by walking over the ground. It gives the location of Conemaugh, Woodvale, and Johnstown. The part colored yellow is where there are no houses left standing except Woodvale Flouring Mill and Factory, the school-house in the part of Johnstown near the stone bridge, the B. & O. depot, and the Cambria Iron Co's. general ware-house and offices. In this yellow area there is not a *part* of a house, as some photographs will show better, and its appearance is that of the bottom of a dried-up river, with rocks, sand, and possibly some heavy trunks of trees, not even a house chimney or wall of any kind to be seen.

In the part not colored yellow (as photographs would better illustrate), about one-half the houses are gone. In the small circle near the lower point of Johnstown, the Club House, Hon. Dan'l J. MOREL L's old residence, the brick school-house, and a few strong brick buildings have evidently saved this in part.

At the upper section, not colored yellow, the churches the B. & O. R. R. depot, and the portion of the town having more brick buildings have evidently performed the same duty.

Kernville lies across Stony Creek opposite Johnstown. You probably have a plan of it on some other map. The houses here were very much wrecked and should probably be classed with the part where they carhalf gone.



Map Showing Destruction in and Above Johnstown by Floods of May 31.

I regret that I have not time to give you something more complete, and a better looking map.

Yours very truly,
J. W. RICHARDS,
Asst. Chief Engineer.

[Our assumption of time consumed was based upon the most reliable testimony then attainable, and seemed to agree with our own estimates of volume of water discharged and of the cross-sections of the valley. But as these estimates were necessarily hurriedly made at the time of our visit, there is doubtless room for error, and as a matter of engineering record we would be indebted to our correspondent for closer data, gathered in a time of less confusion, to supplement the valuable map here presented. In our illustration the "yellow" portion is shown in hatched lines.—ED. ENG. NEWS.]

The Largest Artificial Lake in the United States.

WAPAKONETA, O., July 2, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In your last issue a subscriber asks for the largest artificial reservoir in the United States. I have always heard the St. Mary's or Mercer Co. Reservoir, spoken of as "the largest artificial body of water in the world." It is situated in Mercer and Auglaize counties in the western part of Ohio and is used as a feeder to the Miami and the Erie canal. The amount of embankment is small and it is comparatively low. The water is perhaps not deeper than 20 ft. and is full of tree stumps and logs. The area given is 17,600 A. which I think is somewhat too large. Respectfully,
A. H. HELLER.

[We have received several letters of the same import as the above, and in Stuart's "Civil and Military Engineers in America" we find the following meagre data relating to this reservoir: "The Miami and Erie canal was commenced in 1824 under SAMUEL FORRER, C. E., and DAVID S. BATES, Chief Engineer of Ohio, and JESSE L. WILLIAMS was the engineer in charge of much of the difficult work. The summit level was fed by a system of artificial reservoirs and one of these is spoken of as being still in advantageous use and covering 15,000 acres, and is probably the largest artificial lake anywhere known." The note gives no dimensions, other than the above, and no plans of any kind. This reservoir is 1⅓ miles west of St. Mary's, and extends thence to Celina, Ohio; the distance between these towns is about 10 miles. There is supposed to be a still larger artificial lake in France, but we have no details.—ED. ENG. NEWS.]

The Spillway Discharge at the South Fork Dam.

State Board of Health,—Chief Engineer's Office,
BOSTON, Mass., June 17, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In the editorial columns of your last issue (p. 552) a table is given of the flow which might take place with various depths in the unobstructed spillway of the South Fork Dam. In these estimates no account appears to have been taken of the loss of head at or near the entrance of the spillway required to give the water its velocity. To produce a velocity of 18 ft. per second requires theoretically a fall of 5 ft. from the level in the reservoir to the water surface in the spillway. Consequently, if water having a depth of 4½ ft. is moving with a velocity of 18 ft. per second in the spillway, the water in the reservoir must be 9½ ft. above the bottom of the spillway. I would suggest that the flow through the spillway was no more than would have passed over a weir of the same length and with the same depth of water, and that it was probably very much less. By Mr. FRANCIS' formula, $Q = 3.33\ L.\ H^{\frac{3}{2}}$ assuming $L = 72$, and $H = 4\frac{1}{2}$. I find $Q = 2289$ cu. ft. per second.

Very truly yours,
F. P. STEARNS.

[Our correspondent is no doubt quite correct. We agreed with him so far that we first made the computation for a weir discharge assuming the obstructions to be equal to a solid weir crest one foot high, which is certainly favorable enough. But it gave so small a discharge (H being 3⅓ instead of the 4½ used by our correspondent) that it appeared to us objection might be raised; and in order to give the dam every possible advantage, we used the regular Kutter formula *without* any deduction for the head necessary to produce the velocity. There are some possible reasons for doing this, in that it might be claimed that the computation above was at least fractionally too small. Our main purpose was to show that no assumptions of a "cloud-burst" or other phenomenal freak of nature were necessary to explain the failure of the dam. We were satisfied in giving our computed spillway discharge that it was at least 50 per cent. too large and possibly it was 100 per cent. too large; but there were these reasons why it should be large, to balance possible sources of error: (1) Having only a hand-level to work with, we might be 2 or 3 ins. out in elevation of end of remaining crest; (2) the spillway was slightly bell-mouthed, which was difficult to allow for; (3) the assumption that the part of the crest washed away was a foot lower than the part remaining is after all mere assumption, however practically certain we may be. The essential fact is that, allowing every possible advantage to the dam, no unprecedented storm was required to destroy it, but simply one of those extra heavy rainfalls which always come every 20 to 50 years.—ED. ENG. NEWS.]

Railways in Australia.

TO THE EDITOR OF ENGINEERING NEWS:—

Could you publish in your paper the address of the promoters or chief engineer of the Australian railway

which you mentioned in your Foreign Construction News in your issue of May 4?

A SUBSCRIBER.

[We do not know who are the promoters or engineers of this line, but another line in Western Australia has recently been built by C. & E. Millar, railway contractors, of Melbourne, Victoria, and possibly our correspondent can obtain the desired information from them. Sir CHAS. HUTTON GREGORY, M. I. C. E., of London, is the engineer for colonial railways.—ED. ENG. NEWS.]

Velocity of Flow in the South Fork Spillway.

BROOKLYN, June 26, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

Allow me to call your attention to the computation for flow of water through spillway at the South Fork dam above Johnstown, for different assumed depths given in your number for June 15 (page 552), in which a serious error seems to have been made.

An assumption of a 2 per cent. fall in the surface of water in the spillway is made, and from this the velocities and discharges are computed, *ignoring entirely* the head necessary to produce the initial velocity. The computations of velocities are doubtless correct (I have checked one of them) to the extent that a channel of given dimensions, having given fall of surface of water *and of bed*, would continue to give the stated velocities to its waters provided they already had the same initial velocities. For a velocity of 24 ft. per second a theoretical head would be needed of $\frac{24^2}{64.4} = 8.94$ ft. Hence to give this velocity in the section 72 ft. wide, shown in plan on page 541 to be directly opposite the crest of dam, there would have to be a fall from surface of lake to this point of 8.94 ft., leaving only 1.06 ft. depth of water in the spillway! In fact, the bed of the spillway as well as the surface of the water in it would have to fall this amount (deepening the spillway opposite the crest to the same extent), and this with all losses from friction neglected.

Looking at it in another way, let us suppose that there were no spillway above *a b* (Figs. 2 and 3, page 541),—the reservoir extending to this point,—and that a weir existed at the same locality with a sufficient drop to prevent any retardation of flow of water over the weir from back water. We would then have the maximum obtainable velocities and discharges for the given elevation of bottom of spillway (or crest of assumed wier).

Ftely and Stearns formula for wier, with no end contraction is

$$Q = 3.31\ L\ H^{\frac{3}{2}} + 0.007\ L$$

in which L = length of weir, H = head over crest, and Q = discharge. Omitting the last term, which is comparatively insignificant, and dividing the second member by $L\ H$, the area of section, we have average velocity, $V = 3.31\ \sqrt{H}$. This gives for

Depth	Velocity ft. per sec.	Discharge cu. ft. per sec.
10 ft.	10.5	8820
4½ "	7.0	2025

These velocities are only about two-fifths of those given on the page referred to (840×24 is 20,160 instead of 18,330 as given); and without attempting any exact analysis of the flow in the existing channel, it is evident that, disregarding all obstructions from the bridge piers, iron fish-guard, etc., the discharges for the different depths would not probably be more than one-third of those stated. This of course seriously vitiates the deductions made concerning probable rainfall at the time of the great flood, total discharge per hour from drainage area, etc. in the ensuing paragraphs. J. F. FLAGG.

[The computations in our article were made in great haste and were professedly only quite approximate. The object in view was to roughly show "the most favorable conditions" which could have existed. Some allowance should certainly have been made for the velocity of approach and the acceleration due to a 12-ft. vertical fall about 200 ft. below the bridge across the spillway. Both of these tended to increase the mean velocity, and they were considered as balancing to some extent the neglect of the head necessary to give the initial velocity.—ED. ENG. NEWS.]

Clay and Brick.

NEBRASKA CITY, Neb., June 15, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

Please give me the title and author of the best work published on clays, the manufacture of brick, terra-cotta ware, etc. I have been much interested in the articles on Brick Paving appearing in your journal, and only regret there have not been more Brick for paving purposes is being a good deal agitated and experimented with in the West, and thus far is giving entire satisfaction. Engineers generally are giving the matter a good deal of attention.

A. F. NIMS, *City Engineer*

[Our own articles on this subject have been abstracted and compiled from a number of widely scattered sources, from periodicals, and papers read before engineering societies. We do not know of any special treatise on this subject, but would refer our correspondent to *The Clay Worker*, an excellent journal published in Indianapolis and devoted to the industries mentioned.—ED. ENG. NEWS.]

The Harbor of Bilboa.

PHILADELPHIA, Pa. July 6, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

I just returned from a trip to Europe and it was only to-day I found time to read ENGINEERING NEWS of June 1.

On page 507 you publish a letter from Mr. L. Y. SCHERMERHORN, relating to some remarks made before the Engineers' Club of Philadelphia on the recent improvements of the Harbor of Bilboa. Being the author of these remarks, I am compelled to correct some statements which appear in the letter referred to.

Your correspondent says, "As you will easily see from the endorsed synopsis made by we found no single concave jetty *in the business*." It would have been more correct to say that "no single concave jetty was found in the *endorsed synopsis*." For my part, when I called the attention of the Engineers' Club of Philadelphia to the paper of Mr. M. E. de CORDEMOY. I did not derive my impressions from any "*endorsed synopsis*" but *directly from the original*. To prove that the jetty is a concave one I will state that the middle ordinate is equal to 82 ft.

If Mr. SCHERMERHORN cannot read French, the best thing he can do is to learn it; then he will find that my remarks published in your issue of May 18, are, "reliable statements of the facts" and I may also be able then to use similar expressions in speaking of his remarks. Very respectfully,

ARTHUR MARICHAL.

Rainfall in Ontario, Canada.

The average amount of rain falling in Ontario, says the London *Free Press*, has been taken by the officials of the Magnetic Observatory, Toronto, for the past 48 years. From the published returns of that Institution are gathered the subjoined interesting statistics (less fractions):—

Rainfall in years.....	1882	1883	1884	1885	1886	1887
Cubic inches.....	20½	25¾	20¼	26⅝	27¾	18
Rainy days (summer.....	110	124	123	103	112	106
Fair days (summer)	109	181	184	203	186	203

The average rainfall for the 6 years 1882-1887, inclusive, was (less fractions) 24 ins. It will be seen from the above table that the rainfall for 1887 was about 18 ins., being 6 ins. *less* than the average of the past 6 years, and 9¾ ins. *less* than the average of the last 47 years! The statistics for 1888 are not yet published; but it is clear that we are getting in 1889 part or most of the deficit of 9¾ ins. rain lost in 1887.

PERSONAL.

Mr. J. S. MATSON has been appointed Division Superintendent on the New York, Pennsylvania & Ohio.

Commissioner RICH, of the Western Colorado and Southwestern Ry. Association, has resigned.

Mr. EDWARD STAYMAN, C. E., of Carlisle, Pa., died recently at Sioux City, Ia.

Mr. B. SHEA has been appointed Superintendent of Streets in the Department of Public Works, New York City.

Mr. WM. M. LYON, said to have been the oldest iron manufacturer in the country, died recently at Pittsburg, Pa.

Mr. W. J. MCKEE has been appointed Acting Superintendent of the Cincinnati division of the Chesapeake & Ohio.

Mr. CHARLES. J. WALDO has been appointed Purchasing Agent of the Cincinnati, Hamilton & Dayton Ry., vice Mr. G. W. SAUL.

Mr. MAURICE B. FLYNN, well known as a contractor and politician in New York, died at Long Branch on July 9, from cancer of the stomach. He was not quite 41 years old.

Mr. E. C. MURPHY, of the Indianapolis, Peru & Chicago Ry., has been appointed General Superintendent of the Chicago & Atlantic Ry., vice Mr. T. W. BURROWS, resigned.

Mr. FELICIAN SLATAPER has been appointed Consulting Engineer of the Northwest System of Pennsylvania Lines West of Pittsburgh, from July 1, with office at Pittsburgh.

Mr. THOMAS RODD has been appointed Chief Engineer of the Northwest System of Pennsylvania Lines West of Pittsburg, to succeed Mr. SLATAPER, appointed Consulting Engineer. His office will be in Pittsburg.

Mr. WALTER KATTE, Chief Engineer of the New York Central & Hudson River R. R., and Mr. GEO. H. THOMSON, Engineer of Bridges of the same road, have been elected members of the Institution of Civil Engineers (England).

Mr. W. S. MORRIS, Master Mechanic of the Wabash system, has resigned to accept the position of Superintendent of Motive Power of the Detroit, Lansing & Northern Ry., with headquarters at Detroit, Mich.

Mr. W. C. HALSEY has resigned his position as General Superintendent of the Fremont, Elkhorn & Missouri Valley Ry., and Mr. P. C. HUGHES, Superintendent of the Black Hills division, has been appointed to succeed him.

HORACE A. TAYLOR, of Wisconsin, was appointed Commissioner of Railroads by the President on July 9. Mr. TAYLOR is editor and proprietor of the Hudson (Wis.) *Star and Times*. He was formerly U. S. Consul at Marseilles.

J. HERBERT SHEDD, Providence, R. I., has been appointed Consulting Engineer for the water-works extensions at Wellington, Kan., with WM. M. BROWN, Providence, as Chief and Resident Engineer.

Mr. H. J. HAYDEN, Second Vice-President of the New York Central & Hudson River R. R., has been elected Chairman of the Executive Committee of the Trunk Line Association, filling thus the place of Commissioner ALBERT FINK, until a successor can be chosen.

Messrs. MCNULTY, SKINNER and BARNES, Trustees of the Brooklyn Bridge, have been appointed a committee to consult with Chief Engineer MARTIN, on his return from Europe, on a reorganization of the practical management of the bridge.

Mr. P. LEEDS, Master Mechanic of the Louisville shops of the Louisville & Nashville Ry., has been appointed superintendent of machinery of the entire system, vice Mr. HARVEY MIDDLETON, who has resigned to accept the position of superintendent of machinery on the Atchison, Topeka & Santa Fé.

Mr. H. L. MAGEE, of Kansas City, Division Superintendent of the Wabash Western Ry., has been appointed General Superintendent of the Wabash system, Mr. H. C. MCGRUGAN, Roadmaster, Moberly, Mo., succeeds Mr. MAGEE.

Mr. DENNIS REILLEY, of Easton, Pa., died July 2. He went to Easton in 1864, and as a member of the firm of Reilley, McGrann & Co., built all the masonry, piers and rock work for the bridge of the Lehigh & Susquehanna Ry. and also for the bridge of the New Jersey Central Ry. over the Delaware. The firm changed about 1869 to Reilley & McGovern, and took heavy contracts on the Easton & Amboy and on the Stony Creek road.

Mr. S. L. M. BARLOW, famous as a corporation lawyer, died at his country house at Glen Cove, Long Island, on July 10. He was born in Granville, Mass., in June, 1826; came to New York in 1842, entered a law office and in 1849 was admitted to the bar. Mr. BARLOW was a lawyer of wonderful judgment and tact, and his great success in life is chiefly ascribed to these characteristics. At the time of his death he was a member of the law firm of Shipman, Barlow, Larocque & Choate.

Mr. JENNINGS HOOD, a civil engineer of Maryland, who was reported as dying of yellow fever in Florida last summer, has seemingly turned up in Mexico. The family received apparently authentic proofs of his death, and yet a New York paper contains an advertisement calling upon one SAMUEL W. THORP to communicate with Mr. HOOD in Mexico. Mr. JOHN M. HOOD, President of the Western Maryland R. R. Co., thinks that some one is impersonating his brother and he is investigating the matter.

Col. W. H. PAINE, M. Am. Soc. C. E., has resigned his position as Consulting Engineer of the Brooklyn Bridge. Col. PAINE does this for the reason that he desires the new Board of Trustees to be untrammeled in their management of the bridge. But he also reminds them that he has claims on the cable-grip they are using, together with other patents, and he requests them to make "such settlement as may seem just and proper."

Hon. JOHN NORQUAY, Ex-Prime Minister of Manitoba, died suddenly at Winnipeg on July 5. He was born near Fort Garry, Manitoba, in 1841, of Scotch and Indian parents. He was premier of the province of Manitoba from 1878 to 1888. It was under his leadership that the famous revolt against the Canadian Pacific monopoly occurred, the outcome of which was the building of the Red River Valley R. R., now the Northern Pacific & Manitoba.

Major SWANSON, Master of Transportation on the Houston & Texas Central, Ry., has resigned to go to the Cotton Belt Road as co-receiver and General Manager and the office is abolished. Mr. G. A. QUINLAN succeed him as General Superintendent, and Chief Engineer. Mr. A. W. LITTIG is appointed Superintendent of the

First Division of the Houston & Texas Central, comprising all portions of the main line from the International & Great Northern crossing at Hearne south and the western branch from Hempstead to Austin. Mr. L. A. DAFFIN is appointed Superintendent of the Second Division, comprising all that portion of the system north of Hearne, excepting the Waco & Northwestern Division.

DANA C. BARBER, C. E., died at Knowles, Md., on the 1st inst. Mr. BARBER was a graduate of the Thayer School of Engineering, Dartmouth College; he made a specialty of sanitary engineering, and notwithstanding the drawbacks incident to continued ill health, made an excellent record. He made a very able report on the pollution of the Schuylkill river for the Philadelphia Water Department, and was the author of a very carefully compiled set of house drainage regulations for the city of Washington, D. C. He was also the author of the papers published in this journal in 1886 on the Municipal Engineering of Philadelphia.

Mr. GEORGE H. WATROUS, ex-President of the N. Y., N. H. & H. R. R., died on July 5 in New Haven, aged 60 years. Mr. WATROUS was born in Pennsylvania, studied law and was admitted to the New Haven bar, at which he attained a foremost position. For 20 years he was counsel for the New York, New Haven & Hartford R. R. Co.; he was then a director of the road and from 1877 to 1887 he was President of the road. He resigned by cause of failing health and was succeeded by Mr. CHARLES P. CLARK, but he continued as a director and counsel of the road to the date of his death.

WM. M. LYON, a Fellow of the Am. Soc. C. E., died on July 3, at Pittsburg, Pa., aged 80 years. Mr. LYON, who was intimately connected with the rise and progress of iron manufacture in Western Pennsylvania, was born in Harrisburg, Pa., April 30, 1809, his mother being the daughter of Hon. WM. MACLAY, one of the first U. S. Senators from Pennsylvania, and her mother was a daughter of the JOHN HARRIS from whom Harrisburg derives its name. Mr. LYON was educated at Dickinson College and at Union College, and he studied law for some years but was never admitted to the bar. He preferred active business pursuits and in 1831 became a member of the iron firm of Lyon, Shorte & Co. This was a famous firm, with furnaces and forges on both sides of the Alleghanies, and branch houses in St. Louis, Cincinnati and other cities. During 20 years WM. M. LYON was the actual controlling and directing manager. Aside from business he was a great student of literature, and being blessed with an excellent memory, his command of various information was almost marvelous. A wide circle of close friends loved him for his personal traits, and to not a few he was a counsellor, friend, and guide.

Mr. THOMAS C. MENDENHALL, of Indiana, was made Superintendent of the Coast and Geodetic Survey, on July 9. Mr. MENDENHALL was born near Hanoverton Ohio, in 1841. He was Professor of Physics and Mechanics in Ohio University from 1873 to 1878, and then went to Japan as Professor of Physics in the Imperial University in Tokio. During his stay he organized the general meteorological system of the Imperial Government. In 1881 he returned to the United States and resumed the chair at the Ohio State University. In 1882 he organized the Ohio State Weather Bureau service and subsequently devised a system of weather signals for display on railroad trains. He became a Professor in the United States Signal Service in 1884 and established stations in the United States for the systematic observation of earthquake phenomena. He resigned from the Government service in 1886 to accept the Presidency of the Rose Polytechnic Institute of Terre Haute, Ind., which position he still holds. Besides membership in other scientific societies, Prof. MENDENHALL has held the offices of Vice-President of the Physical Section of the American Association for the Advancement of Science and President of the National Academy of Sciences.

Book Reviews.

Brown's Directory of American Gas Companies. Gas Statistics. Compiled and corrected by E. C. BROWN. 7 x 10½ ins., cloth bound, 104 pp. Press of *Progressive Age*, New York, 1889.

The second issue of the *Directory* gives statistical and other information regarding the gas works of the United States, Canada, and Mexico. The States are arranged in alphabetical order, as are the companies in each State. Information is given of the officers of each company, the process used in manufacturing gas, the present population, the price of gas in 1888, and if the company also operates an electric light plant, a statement is made to that effect, giving the system, and the number of arc and incandescent lights. Near the close of the book the same statements regarding natural gas, and parent or operating companies are presented, together with a list of gas associations and their officers.

The closing pages give a *resumé* by States of the gas companies operating electric lighting plants, of which there were at the beginninn of 1889 a total of companies, operating in connection with their gas plants 21,314 arc and 55,890 incandescent lights, or a total of 77,203 lights. Of this total the summary shows that the leading system is the Westinghouse, with 27,710 incandescent lights; and the second, the Thomson-Houston, with 11,084 arc and 8,826 incandescent, or a total of 19,910 lights. It should be borne in mind that these figures are only for electric lighting plants operated by gas companies. The late increase in these plants has been very rapid.

It is to be regretted that the summary just referred to is the only one in the book, the number of companies in each State, or in the United States even, not being stated. The book would be more valuable with these figures, and with two other summaries, one showing the practice in various sections and the whole country as to processes used in manufacturing gas, and the other the range and the average of prices charged consumers.

The completeness of the statements regarding each company shows great persistence on the part of Mr. BROWN, as any one who has ever tried to collect statistics will see upon examining the book.

PUBLICATIONS RECEIVED.

—*The Use of Metal Track on Railways as a Substitute for Wooden Ties.* By E. E. RUSSELL TRATMAN, C. E. To which is added a report of experiments in wood seasoning by the Chicago, Burlington & Quincy R. R. Co., and other notes. Compiled by B. E. FERNOW, Chief of Forestry Division, Department of Agriculture. Bulletin No. 3 of the Department. Washington, D. C., 1889.

This is a useful and interesting *resumé* of the status of the metallic tie question in Europe, America and the Colonies. Very full statistics are given, showing the extent to which metal ties are used in each country. Mr. TRATMAN also adds a list of American patents relating to metal railway track dating back as far as 1839. This list is an unexpectedly long one. A good specification for wooden cross-ties, and notes on the use of chestnut-oak ties are included.

—*Third Biennial Report of the Railroad Commissioner of the State of Wisconsin.* Embracing the period ending June 30, 1888. ATLEY PETERSON, *Commissioner*. 6 x 9 ins. cloth bound, 442 pp.

Wisconsin is one of the few States which can afford only a biennial report from their Railway Commission. The present volume is principally taken up by the detailed reports of the railway companies operating within the State. The commissioners' report proper occupies but 37 pages. The volume is well gottten up and neatly bound, but the very numerous typographical errors show such careless proof reading that one hardly dares to trust the statistics it contains.

—*Form for Annual Report to the Interstate Commerce Commission of the United States*, for the year ending June 30, 1889.

The form this year is similar in its general make-up to last year's form, a neat book 9¼ x 12 ins. in size, containing 41 pages, 10 more than last year's form. The changes are quite numerous and are doubtless the result of last year's experience. One cannot but wonder in looking over these blanks, whether the vast amount of labor expended in collecting the detailed information asked and in classifying and compiling it by the railway accounting departments and the statistical department of the Interstate Commission, is going to bring results proportionate to its cost. Doubtless, thoughts in the same line will be expressed more forcibly in a good many auditing departmants during these hot summer days.

Not that we would favor any curtailment in the publication of statistics; but it is to be remembered that statistics are of value only as they are simple enough to be comprehended. Should not our line of progress be toward the great simplification of the complex affairs of our railway corporations, especially in their finances and their relations to each other? Until something is done in this direction the most carefully prepared statistics will lose a great part of their value, because their significance is only apparent to an expert.

—*Annual Report of the Department of Public Works, Chicago, Ill., for 1888.* 541 pp.

This report contains the reports of the Commissioner of Public Works, City Engineer, Engineer of the Pumping Plant, etc. etc., and gives very full details of extent and cost of work done. There are photographs of Commissioner SWIFT, a new pay wagon, and the Jackson St. bridge and viaduct, also plans of bridges and viaducts, pumping stations, and the shore inlet of the waterworks.

—*Resources of Wyoming.*—This is an illustrated official publication compiled by the Secretary of the Territory, giving particulars of the soil, climate, products, advantages, geography and topography, etc. There is also a statement on irrigation by ELWOOD MEAD, Territorial Hydraulic Engineer. The mining laws of the Territory are given and there is also a large map.

—*Report on the Construction of the Water-Works at Little Falls, N. Y.* By the Engineer, S. E. BABCOCK. Published with the first annual report of the Water Commissioners.

Mr. BABCOCK's report is one of great interest, describing the works in detail and giving specifications for salt-glazed vitrified pipe and pipe laying. It is illustrated by photographic views and reproductions of drawings.

—*Cable Traction Systems of the Rapid Transit Cable Company of New York.*—President, CORNELIUS TIERS, Vice-President, ANDREW BRYSON. Office, 12 Broadway, New York.

This is a well written and profusely illustrated description of a new system of cable traction, particularly adapted for elevated railway service in addition to its application on surface or underground roads. We expect to illustrate the system fully in an early issue.

—*Railway Statistics of Canada*, and Capital, Traffic and Working Expenditure of the Railways of the Dominion. —Pamphlet 6¼ x 9¼ ins., 60 pp., many tables. COLLINGWOOD SCHREIBER, Chief Engineer and General Manager, Ottawa, Ont.

The above is the annual Blue Book for the year ending June 30, 1888. It shows 12,701 miles of completed railway in the Dominion, and 14,232 miles of track. The report is accompanied by two large tabular sheets, one giving the usual summary statement of capital for each of the companies, the other a list giving the name and address of the chief officer of each railway line in the Dominion, including those under construction on June 30, 1888. We reprint these last in our column of Railway News.

—*Interstate Commerce Commission.*—Revised and Amended Rules of Practice in Cases before the Commission, adopted June 8, 1889. Washington, Government Printing Office. Pamphlet 6 x 8 ins., 24 pp.

These rules and forms, planned to systematize and convenience actions before the Commission, are needed by any who may have occasion to bring or defend a case there. They may be obtained from Mr. E. A. MOSELY, Secretary to the Commission.

—*Decisions of the Board of Railroad Commissioners of the State of Kansas.*—The City of Wichita vs. The Atchison, Topeka & Santa Fé and other railways. Decision on original complaint and on rehearing. Pamphlet, 6 x 9 ins., 18 pp.

In this pamphlet the Kansas Railroad Commission give the grounds on which they reached their recent decision, granting special "jobbing rates" to the ambitious city of Wichita. The question at issue is "local discrimination," it being claimed and substantially proven, that the specially favorable rates secured by points on the Missouri river prevent the infant and growing industries of Wichita from any further development. The Commission in their decision propose to remedy this by extending these special rates to benefit Wichita, instead of by raising the specially favorable rates under which Kansas City now gets ahead of Wichita in the race of competition. Where this course of action will lead, and where the Commission propose to draw the arbitrary line between cities which deserve jobbing rates and cities which do not, is yet to be seen.

—*Constitution and By-Laws of the American Water-Works Association, together with the Proceedings of the 1st, 2d, 3d, 4th, 5th, and 6th annual sessions*, held at St. Louis, Mo., 1881; Columbus, O., 1882; Buffalo, N. Y., 1883; Cincinnati, O., 1884; Boston, Mass., 1885; Denver, Col., 1886. Cloth, 5½ x 8 ins., 370 pp., Minneapolis. Printed by order of the Association, under the direction of a committee consisting of G. E. BEACH, Chairman, Minneapolis, Minn.; I. L. LYMAN, Lincoln, Neb.; and W L. CAMERON, Memphis, Tenn.

This volume contains much valuable matter for water-works men, including all the papers and discussions at six annual meetings of the Association. The various papers treat of almost every question connected with water-works construction and maintenance. Mr. G. E. BEACH, 21 Central Ave., Minneapolis, Minn., has several copies of the book for sale.

—*Data for Electric Power, etc.*

This is a series of six small, convenient handbooks on the application and care of electrical appliances, in connection with a number of industries, as issued by the Sprague Electric Railway & Motor Co. of 16 and 18 Broad St. N. Y. A list of their titles will give a better idea of the scope and purpose of these useful little books of reference. They are: The Electric Transmission of Power for Mining Work, 2 vols. Data for Electric Power Stations. The Sprague Electric Motor, for Railway Work. Facts as to the Sprague Electric Motor and The Boston West End Railway, operated on the Sprague System. All of these books are excellently illustrated and the text is clearly and concisely written by experts. They are very handy things to have about the office of every engineer.

—*Les Annales des Ponts et Chaussées*, for February, 1889, containing an article with over 200 octavo pages of text

by EYRIAND DES VERGNES, C. E., on the dredging and preservation of an entrance to the harbor at Dunkirk through sinking sands.

The article is very full in its detail of methods, commencing with the selection of the dredge and the work performed by various types of dredges at many other points. A sand pump was finally adopted, and the author enters very minutely into its operation, cost, capacity, etc. The work includes an historical account of the sand bars of Dunkirk and their affecting conditions, and this portion is accompanied by a series of maps of the bars from 1658 to 1879. The author then treats of jetties and the proposed system of improvement at this harbor.

—Modern Electricity. What is Electricity? Its Relation to Magnetism: How it is utilized, and how utilized in the Arts. With Glossary of Electrical Terms. By Thomas Kirwan. Boston, De Wolfe, Fiske & Co., Publishers. Price, 30 cents.

This is a compilation in a popular form from a number of good authorities. Questions may doubtless arise which will not be answered in this volume of 128 small octavo pages, but the author gives his readers much more than the selling price would imply.

—Transmission of Power by Fluid Pressure. By William Donaldson, M. Inst. C. E. E. & F. Spon, Publishers, London and New York, 1888.

This work relates to the application of compressed air and its efficiency as compared with high-pressure water, etc. The application of air and water to pumping sewage is especially treated. This work discusses the question from a theoretical and practical standpoint, but deals with formulæ and general laws, and not with any particular system or machine. An appendix, however, describes and illustrates the automatic pumps invented by the author and used in pumping the Lymington sewage. These pumps are fully described.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—At the regular meeting of July 3, Col. W. H. PAINE presiding, the only business was the following announcement of members elected:

As Members—WALDO EMERSON BUCK, Eng. of Water Power Co., Lake Village, N. H. WILLIAM HOWARD COURTENAY, Assistant Engineer Southern Division Louisville & Nashville R. R., Montgomery, Ala. ROB. BENJAMIN DAVIS, Manager Bridge and Construction Department, Pencoyd Iron Works, Pencoyd, Pa. LOUIS HYDE EVANS, Division Engineer Chicago & Northwestern Railway, Chicago, Ill. JOACHIM GODTSKE GIAVER, in charge of Engineering Department, the Shiffler Bridge Works, Pittsburg, Pa. EDWARD GILLETTE, Jr., Locating Engineer Burlington & Missouri River R. R. in Nebraska. WILLIAM RUFUS NORTHWAY, City Engineer, Chicago, Ill. SAMUEL HARRISON SMITH, City and County Surveyor and City Engineer, San Francisco, Cal. BENJAMIN THOMPSON, in general engineering practice, Chattanooga, Tenn. PAUL SOURIN KING, Civil and Consulting Engineer, New York City.

As Associates—JULIUS I. LIVINGSTON, Manager Standard Paint Co., Bound Brook, N. J. THOMAS SPENCER MILLER, Engineer-Salesman Lidgerwood Mfg. Co., New York City.

As Juniors—NORMAN SMITH LATHAM, Draughtsman in office Union Elevated R. R., Brooklyn, N. Y. LUDWIG PAUL WOLFEL, Assistant Engineer Pencoyd Bridge and Construction Co., Pencoyd, Pa.

Montana Society of Civil Engineers.—At a recent meeting at Helena, Mont., Mr. CARTER addressed the society, calling attention to the subject of irrigation and the reclaiming of the arid lands of this Territory by the construction of storage reservoirs. He stated that the Senate Committee of Congress would visit the Territory in August to investigate the subject and secure information on which to make a report to Congress, and suggested the propriety of the society's making a move to collect and put in a presentable shape such data to lay before the committee. Mr. CHILD also addressed the society, calling their attention to several possible reservoir projects in the Ten Mile and Prickly Pear valleys, and in urging the importance of the subject he stated that men were now watching their irrigating ditches in this valley with shot-guns, that the growing crops were drying up for want of water, and that the losses in this valley alone would aggregate $500,000 this season.

After a general discussion of the subject it was voted to appoint a committee of fourteen, of which the first six constitute a sub-committee, to collect such data. President GREEN appointed the following committee: Col. W. W. DELACY, W. A. HAVEN, F. L. SIZER, J. S. KEERL, G. O. FOSS, E. H. BECKLER, GEO. SCHEETZ, of Miles City, J. M. PAGE, of Twin Bridges, C. G. GRIFFITH, of Great Falls, H. B. DAVIS, of Deer Lodge, GEO. T. WICKES, of Helena, JOS. H. HARPER, of Butte, ELLIOTT H. WILSON, of Butte, and E. A. CRALLE, of Philipsburg.

Denver Society of Civil Engineers and Architects.—At the regular monthly meeting on June 11, President NETTLETON in the chair and 24 members present. A. I. FONDA was elected second Vice-President and W. W. FOLLETT, Treasurer. These two offices were newly made by the revised constitution.

The greater part of the evening was devoted to a discussion of the paving question, a live subject in Denver at present. It was the opinion of the members present that the hardest Colorado sandstone was the proper material with which to pave streets with heavy traffic, but that the streets of lighter travel ought to be paved with Trinidad asphalt. E. P. MARTIN, *Secretary.*

Roadmasters' Association of America.—The annual meeting will be held at Denver, Col., Sept. 10, 11 and 12. The committee appointed to prepare a programme of questions for discussion have submitted the following:

1. Standard Track Joints, R. CAFFREY, Chairman.
2. Standard Frogs, P. NOLAN, Chairman.
3. Labor on Track, O. F. JORDAN, Chairman.
4. Automatic Switch Stands and Protection of Facing Points, ROBT. BLACK, Chairman.
5. Track Tools and Implements, S. L. SWINNEY, Chairman.
6. Standard Cattle Guards, J. DOYLE, Chairman.

J. W. CRAIG, *President*, Charleston, S. C. H. W. REED, *Secretary*, Waycross, Ga.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Concord.—The rebuilding of that portion of the old New Hampshire Central R. R. between North Weare and Henniker, N. H., about 8 miles, now known as the Manchester & North Weare R.R., the rights and franchises of which are owned by the Concord R. R. Co. is being agitated. The New Hampshire Central R.R.Co. was incorporated in 1845 to build a railway from Manchester via North Weare and Henniker to Claremont, and the line was completed to Henniker in October, 1850. The company becoming financially embarrassed, was consolidated with the Concord & Claremont R. R., now a part of the Boston & Maine system, and shortly after the line from North Weare to Henniker was abandoned and the track torn up. The building of the line would give the towns along the Manchester & North Weare R. R. direct connection with Henniker and the Boston & Maine R. R. and save the present long haul via Concord. The city of Manchester has promised $50,000 in aid of the enterprise.

A bill has been introduced into the New Hampshire House of Representatives providing that the State shall take possession of this company's property of whatever character, and sell the same to AUSTIN CORBIN, of New York, and R. K. Dow and JOHN L. FARRELL, of Claremont, N. H. The amount to be paid for the road is to be decided by the Supreme Court.

Lake Shore.—The grading of this road from Alton Bay to Laconia, N. H., 15 miles, has been completed ready for tracklaying.

New York Central & Hudson River.—This company has secured a terminus on New York bay. A stretch of water front about 3 miles long between Constable Hook and Calvan Point, will be used for terminal facilities.

Potts.—The extension of this Michigan lumber road to Au Sable is completed and the road will begin to run both freight and passenger trains immediately.

Ohio & Mississippi.—This company will use a part of its new issue of bonds, amounting to $24 000,000, in building a branch from Shawneetown, Ill., to Paducah Ky., a distance of about 53 miles.

Tilton & Belmont.—This road which is to run from Tilton to Belmont, N. H., a distance of 6 miles, has been graded ready for tracklaying.

Perry County.—McGovern & Co., of Tyrone, Pa., have the contract for building this road from New Bloomfield to Duncannon, Pa., a distance of 11 miles. The road is to be completed in 90 days.

Gettysburg & Harrisburg.—The engineers engaged in making the survey for the extension of this road to Washington, D. C., have reached Sandy Springs, Md., near the Frederick county line, and are pushing on through Montgomery county. Col. A. E. LEHMANN, of Philadelphia, is in charge of the party.

Buffalo, Rochester & Pittsburg.—About 150 men are at work on the coal branch of the Lincoln Park & Charlotte R. R., which runs from a point on the main line near Barnard's crossing east to the river, about 1½ miles. The new branch will cross the Charlotte branch of the New York Central & Hudson River R. R. on an overhead bridge. There will be considerable heavy rock work and it is not expected to begin tracklaying before Aug. 1. The bridges and trestle work on the main line have been completed and tracklaying will soon begin.

Pittsburg & Western.—The Northwestern Dock Co., organized in the interest of this company and now operating the docks at Fairport on Lake Erie, the terminus of this road, will, it is stated, build docks at Duluth and Chicago and possibly other lake ports in the Northwest. A line of lake steamers will be run in connection with the road.

Philadelphia & Reading.—This company is making extensive improvements on the main line by widening the tunnels, relaying the track with heavier rails and placing the tracks further apart. The main work will be in widening the tunnels. The two most important of these are the Flat Rock tunnel on the west side of the Schuylkill river near Manayunk, Pa., and the Black Rock tunnel located just above Phoenixville, Pa. The Flat Rock tunnel is about 1,000 ft. long and the west side has been cut away and the track relaid and in operation. The east side is well under way and it is expected to have the entire work completed in about one month. The Black Rock tunnel is 1,931 ft. long and the work of enlargement will be very heavy on account of the large amount of rock work.—It is stated that the proposed branch of the Northeast Pennsylvania R. R. from Hartsville to New Hope, 12 miles, has been abandoned for the present.—The citizens of Haddonfield, N.J., are trying to inouce this company to build a branch to that place.

Baltimore & Eastern Shore.—Godeffroy & Howe, of Easton, Md., who have the contract for building this road, from Broad Cove on the Eastern bay, to Salisbury, Md., 54 miles, will receive bids for grading in sections of 5 miles or more.

Confluence & Oakland.—Grading is now being pushed on this road, which is to run from Confluence, Pa., to Oakland, Md., a distance of 45 miles, and tracklaying will soon begin. It is intended to complete 20 or 25 miles this year and the remainder in 1890. J. BAYARD HENRY, 742 Drexel Building, Philadelphia, Pa., is President.

Ulster & Delaware.—The New York State Railroad Commissioners have decided that this company need not complete the extension from Hobart west. The town of Harpersfield, which was bonded for the construction of the original line, has been endeavoring to compel the company to build the extension through its territory.

New York & New England.—This company will replace the Howe truss bridge just west of Willimantic with an iron structure during the present season. Work is now in progress filling the Hop brook trestle. About 90,000 cu. yds. of material will be needed and of this about 8,000 cu. yds. is in place.

Montpelier & Wells River.—The Barre Branch R.R. from Barre to Barre Junction has been leased to this company for 99 years.

Johnsonburg.—This road, running from Johnsonburg to Claremont, Pa., 18 miles, has been leased to the Pennsylvania R. R. Co.

Housatonic.—The New Haven & Derby R. R., running from New Haven to Ansonia, Ct., has been leased to this company for a period of 99 years. It will be known as the Derby division of the Housatonic R. R.

Toledo, Ann Arbor & North Michigan.—The officers of this company have ordered work on the line from Big Rapids to Mount Pleasant, Mich., 40 miles, to be commenced at once.

Delaware & Hudson Canal Co.—Extensive improvements will be made on the Adirondack R. R. Seven of the 18 wooden bridges will be replaced with iron structures, a large amount of trestle will be filled, and other improvements in the road bed will be made.

Projects and Surveys.

Grand Rapids & Mineral Springs.—The following information has been sent us by F. W. STEVENS, of Grand Rapids, Mich., Chief Engineer:

This road is projected to run from Grand Rapids to Mineral Springs, a distance of 2¼ miles. The surveys have been made and right of way secured. The object of the road is to form a connecting link between the Detroit, Grand Haven & Milwaukee, and the Lake Shore & Michigan Southern and the Chicago & West Michigan railways, and to open up the real estate along the route. A large tract of land has been purchased by the company and will be laid out into factory sites and pleasure resorts. It is intended to build the road in a first-class manner. The contracts for construction will be let July 15, and it is expected to have the line in operation by Oct. 1. The company was incorporated May 9, 1889. C. S. EDWARDS, of Grand Rapids, is President.

Delaware & North River.—Incorporated in New York to build a railway from Summitville via Napanock, Pine Bush, Marbletown and Hurley, to Kingston, a distance of about 45 miles. The capital stock is $500,000. Among the incorporators are: O. P. HOWELL, of Port Jervis, N. Y.; D. U. COX, of Ellenville, and WILLIAM MORRIS, of New York.

Columbia & Rensselaer.—The towns of Valatie, Kinderhook, and Stuyvesant Falls, N. Y., have subscribed $5,669 in aid of this road. The road is projected to run from Hudson to Niverville, a distance of 15 miles. The projectors say that unless the right of way be granted, free of cost, the enterprise will be abandoned.

Raritan Valley.—Surveys are in progress for a railway to run from a point on the Millstone branch of the Pennsylvania R. R., via New Brunswick, Ford's Corners and Woodbridge to Perth Amboy, N. J.

SOUTHERN.—Existing Roads.

Louisville & Nashville.—Contracts for building the line from Cumberland Gap to Princess Flats will be let about Aug. 1. R. E. O'BRIEN, of Louisville, Ky., engineer in charge, will furnish information.—Winston

Bros. of Minneapolis, Minn., have the contract for building the double track from East Louisville to Anchorage, 10.1 miles, and from South Louisville to Shepherdsville, 15.7 miles.——Surveys are in progress for the double track from Boyles to Oxmoor, Ala., 9.7 miles, and contracts will be let soon.

Dauphin Island.—Work has been resumed on this road under the direction of the engineers, S. K. WRIGHT and J. P. BARTHOLOMEW. The line is projected to run from Mobile to Dauphin Island, Ala., 32 miles.

Lexington Belt.—The contract for building this road has been let to Michael Dolan & Sons, of Lexington.

Seaboard Air Line.—Proposals for the grading, masonry, and trestles of 50 miles of the Georgia, Carolina & Northern R. R. will be received by R. H. TEMPLE, Chief Engineer, of Chester, S. C.

Clarksburg, Weston & Midland.— The contract for changing this road to standard gauge and making other improvements in the roadbed has been let. The work is to commence in 15 days and is to be completed by Dec. 15.

Savannah, Dublin & Western.—This bankrupt Georgia road has been sold to B. A. DENMARK for $35,000.

Atlantic & Danville.—It is stated that work will soon be commenced on the extension from Danville, Va., to Bristol, Tenn.

Atlantic Coast Line.—The grading has been completed on the extension from Bethel to Greenville, N. C., and tracklaying is now in progress.

South Bound.—It is announced that arrangements have been made by which the funds necessary to build this South Carolina road have been secured.

Central R. R. of Georgia.—The contract for building 40 miles of the Savannah & Western R. R., west from the Ogeechee river, has been let to Wright & Struthers, of Savannah, Ga.

South Atlantic & Ohio.—Mason, Gooche & Hoye, of Frankfort, Ky., who have the contract for building the extension to Big Stone Gap, Va., have sublet the contract. Work is in progress.

Richmond & Danville.—Tracklaying on the Wilkesboro extension has reached a point 8 miles beyond Rural Hall. The line is to be completed to Wilkesboro this season.

Cape Fear & Yadkin Valley.—Work is in progress on the branch from Millboro to Columbia factory.

Louisville, St. Louis & Texas.—The contract for building the branch from Irvington to Hardinsburg, Ky., has been let to Tansy & Corrigan.——It is stated that a branch from Welden to Brandenburg, Ky., about 2½ miles is under consideration.

Louisville, New Orleans & Texas.—The branch from Rolling Fork to Hampton, Miss., is nearly completed.

Georgia Pacific.—Surveys are reported in progress for a line to run from Greenwood to Sharkey, Miss.

Cincinnati, New Orleans & Texas Pacific.— The contract for building locomotive shops at Meridian, Miss., for the New Orleans & Northeastern R. R. has been let to H. C. Jackson. The building will be of brick and will contain stalls for 6 locomotives. The cost of the structure will be $18,000.

Central R. R. of Georgia.—It is announced that the bonds of the Savannah & Western division projected to run from Birmingham, Ala., to Savannah, Ga., a distance of 185 miles, have been placed and construction is already in progress. Additional contracts for construction on the remainder of the line will be let soon.

Owensboro, Falls of Rough & Green River.—The grading has been completed from Owensboro to Fordsville, Ky., and tracklaying is now progressing at the rate of 1 mile per day. It is expected to have the entire line from Owensboro to Falls of Rough, 38 miles, completed by September.

Kentucky Midland.—The citizens of Mt. Sterling, Ky., have promised to subsidize the road to the amount of $150,000, if the company will build an extension from Frankfort to that place. It is probable that the line will be built.

Savannah, Americus & Montgomery.—The one mile trestle across the Ocmulgee swamp is nearly completed. The line between McRae and Abbeville is nearly ready for the track.

Projects and Surveys.

Guntersville, Fort Payne & Chatooga Valley.— The officers of this company, which proposes to build a railway from Guntersville, Ala., to Rome, Ga., 75 miles, are: W. H. RICE, President; J. M. SPALDING, Vice-President; F. H. TOBEY, Treasurer, and C. O. GODFREY, General Manager.

Chattanooga, Gadsden & Birmingham.— This company has been incorporated in Alabama to build a railway from Gadsden, Ala., to the Georgia State line.

Tuscaloosa Belt.—Incorporated in Alabama by W. C. JEMISON, W. J. COCHRANE, THOS. B. ALLEN, W. C. FITTS, and others. It is stated that the company will purchase the dummy line of the Tuscaloosa Coal, Iron & Land Co., and extend it to the Warrior river.

Moyock & Dismal Swamp.—It is stated that engineers are at work making surveys for a railway from Moyock, N. C., through the Dismal Swamp to South Mills on the Dismal Swamp canal.

Tobacco Belt.—Organized in Floridato build a railway from Belleville, Fla., via Madison, to the Gulf of Mexico, a distance of about 90 miles. Among the incorporators are: L. B. PLUMBER, of Jacksonville; W. S. JORDAN, H. J. MCCALL and others.

Orlando & Indian River.—This company has been incorporated to build a railway from Orlando, Fla., via Narcoosee and Melbourne to Lake Worth. M. R. MARKS, E. K. FOSTER, and E. R. GUNLEY are among the incorporators.

Paducah & Tennessee.—It is announced that work will commence on this road within 30 days. THOS. H. PURYEAR, of Paducah, is President.

St. Louis & Birmingham.—A press report states that a contract has been let for building 120 miles of this road. There seems no reason to credit the rumor.

Palatka & Lake Shore.—This railway company has been incorporated in Florida.

West Virginia & Kanawha.—This company has been incorporated in West Virginia by T. L. BROWN, of Charleston, W. Va., S. T. TEAYS, of St. Albans, W. Va., CHAS. A. DRAPER and others. The object is to open up the Coal river region.

Madisonville & Owensboro.—A charter will be asked for at the next session of the Kentucky Legislature for a line of railway from Madisonville to Owensboro, Ky. Surveys are now in progress.

Macon & Birmingham.—The Macon Construction Co., of Macon, Ga., will award the contracts for constructing 100 miles of this line July 15, W. H. WELLS, of Macon, is Chief Engineer.

NORTHWEST.—Existing Roads.

Northern Pacific.—The engineers sent out by this company to examine the route of the great Northwest Central R. R. report a very favorable line.——The contract for grading the Jamestown & Northern R. R. has been let to Edward McCormick, of Jamestown.

Centralia & Chester.—At a recent meeting of the stockholders of the Centralia & Ste. Genevieve, and the Centralia & Altamont railways, it was voted to consolidate with this company. The company now has a franchise for a road from Altamont to Ste. Genevieve. The old officers of the Centralia & Chester were retained.

Pacific Short Line.—Grading is nearly completed on the line between Plainview, Neb., and Sioux City, Ia. The engineers are now at work between Plainview and O'Neil, Neb.

Canadian Pacific.—The contract for the construction of the Regina & Long Lake R. R. has been let to Ross & Onderdonk.

St. Louis & Chicago.—Tracklaying will soon begin on the extension from Mt. Olive to Alhambra, Ill., and it is expected to have the line completed by Aug. 1.

Projects and Surveys.

Duluth, Rainy Lake River & Southwestern.—A corps of engineers under the direction of W. B. BANKS, of Superior, Minn., are making the surveys for this road which is projected to run from Duluth to Winnipeg. The route runs just west of Island and Boulder lakes, crosses the Embarrass river at its junction with the Partridge river and passes across the northeastern corner of the Riel Lake Indian reservation and near Lake of the Woods. The road would open up some fine timber and mineral country.

Missouri River, North Platte & Denver.—LORAN CLARK, of Albion, Neb., President, sends us the following:

The surveys are now being made for this road which is to run from Albion, via Cedar Rapids, Greeley Center, Scotia and North Platte to Denver, a distance of 450 miles. There will be one large bridge across the Platte river. No local aid has been asked for yet, but the people are in favor of the road and it is expected that subsidies will be easily voted by all the towns along the route. J. W. ANDREWS, is Chief Engineer.

Kickapoo Valley & Northern.—We have received the following information from B. F. WASHBURNE, of Excelsior, Wis:

This road is projected to run from Woodman, Wis., via Waukesha and Soldiers Grove, north 150 miles. About 80 miles of this distance is now under survey. The route is through a fine farming and stock raising country, affording easy grades and curves. The principal business of the road will be in farm products, lumber and minerals. About 40 miles of the right-of-way has been secured. No other local aid has been asked for yet but it is expected that $1,000 per mile can be easily secured. Constracts for construction will be let about Oct. 1, 1889. JAS. APPLEBEE is Chief Engineer.

SOUTHWEST.—Existing Roads.

Chicago Rock Island & Pacific.—The contracts for building the extension from Pond Creek, Indian Territory, to Kingfisher, a distance of 65 miles have been let.

Des Moines & Kansas City.—This company has issued $500,000 of bonds to aid in the extension of the line from Cainsville to Kansas City and other contemplated improvements. It is intended to expend $125,000 in reducing grades and curves. Improvements will also be made in the rolling stock and a large quantity of new steel rail will be laid.

Texarkana & Northern.—The Missouri Bridge Co., of St. Louis, has the contract for building the bridge across the Red River. The contract price was $120,000. The contract for constructing the first 17 miles north of the Red River has been let to Griswold Bros. of St. Louis.

Winner Investment Co.—The new railway being built by this company on the north side of the Missouri river will soon be completed and running to Linden, Clay county, 8 miles north of Harlem. The engines and other rolling stock for the road are on hand and will probably be running within 10 days.

Red River, Sabine & Western.—It is announced that the Fort Worth Construction Co., which has the contract for building this road from Nacogdoches to San Augustine will commence work at Palestine, Tex., August 1.

Louisville, New Orleans & Texas.—The branch from Slaughter to Bayou Sara, La., 15 miles, has been completed.

Denison & Wachita Valley.—This company has secured the right of way for its line and will begin construction at once.

Stuttgart & Arkansas Post.—The contract for building this road has been let to T. H. Leslie. The road will run from Stuttgart to Arkansas Post, Ark., 45 miles.

Missouri Pacific.—Surveys have been made for the extension of the Fort Scott, Wichita & Western R. R. from Fort Scott to Walnut, Mo., 25 miles. It is stated that work will commence soon. The company also has under consideration the extension of the Minden branch from Chetopa, Kan., to a connection with the Arkansas Valley division. An extension of the Emporia division to Sedalia is also talked of.

Southern Pacific.—The tracklayers on the extension to Beeville, Tex., have now reached a point 13 miles from that place.

Kansas City, Wyandotte & Northwestern.—At a meeting of the stockholders of this company recently held it was voted to increase the capital stock $4,500,000. The money is to be used in purchasing the Topeka, Lawrence & Carbondale R. R. and building the lines from Carbondale to Wichita and from the Kansas State line to Beatrice, Neb.

Kansas City, Watkins & Gulf.—Kennedy & Stone, who have the contract for building 50 miles of this road, have commenced work near Lake Charles, La. This portion of the line is to be graded ready for the rails by Jan. 1, 1889. The road is projected to run from Lake Charles northeast through some of the finest timber and agricultural lands in Louisiana to Kansas City, Mo. J. B. WATKINS, of Lake Charles, is President.

Rio Grande & Eagle Pass.—It has been decided to extend the coal branch to the new coal fields on the banks of the Rio Grande, about 35 miles above Laredo.

Missouri, Kansas & Texas.—This company, through its receivers, GEO A. EDDY and H. C. CROSS, has leased the Kansas City & Pacific R. R., running from Coffeyville, Kan., to Paola, Kan., 125 miles. This gives the company a through line from Kansas City to Houston, Tex.

Chicago, St. Paul & Kansas City.—It is stated that this company will build an extension from Savannah, Mo., northeast, via Fillmore and Graham to Rockport, a distance of 55 miles. The grade of the old Missouri Valley R. R. will be used for a portion of the distance.

Projects and Surveys.

Kansas City, Independence & Lee Summit.—WM. KNIGHT, of Kansas City, Mo., Chief Engineer, writes us as follows:

This road is projected to run from Kansas City to Lee Summit, a distance of 17½ miles. The preliminary surveys have been completed and about ⅗ of the right-of-way secured. The maximum grade will be 52-ft. per mile. J. W. MERCER, of Independence, Mo., is President.

Wyandotte & Quindaro.— We have received the following information from W. P HOGARTY, of Quindaro, Kan:

The surveys are completed for this dummy line, which is to run from the junction of the Interstate Elevated R. R. and the Kensington line to Quindaro, of from 2½ to 5 miles. There will be no heavy grades or curves. The right-of-way has been obtained and other local aid, amounting to 20 per cent. of the value of the abutting property, secured. The road will do a local, freight, and passenger business. JAS. GREEN, of Lawrence, Kan., is President, and S. J. HATCH is Chief Engineer.

Arcadia, Alexandria & Fort Smith.—We have received the following information concerning this enterprise from A. L. ATKINS, of Arcadia, La., President:

This road is projected to run from Arcadia to Alexandria, La., a distance of 100 miles. About 50 miles of the road north has been surveyed and the surveys south will be commenced immediately. The route is through a fine timber and farming country, and it is expected that the road will obtain a large business in cotton, lumber, farm produce, and general merchandise. It is intended to construct 15 miles of the road at once. Contracts will be let in about two weeks and it is expected to have this 15 miles completed within one year. L. M. POLK is Chief Engineer.

Kansas City, Monett & Southern.—B. F. HOBART, of St. Louis, Mo., President, writes us that this road is projected to run from Monett, via Lockwood, Nevada and Louisburg, to Rosedale, Kan., a distance of 171 miles. The surveys have been completed and about 50 miles of the right of way secured. A large local traffic is expected.

ROCKY MT. AND PAC.—Existing Roads.

Denver & Rio Grande.—Tracklaying has been completed on the branch from Spinero to Dake City, Col., a distance of 36 miles, and it is expected that the line will be in operation by July 5. The track has been laid on the line from New Castle to Rifle creek to within 5 miles of Rifle creek, and the prospect for the early ex-

ension of the road to Grand Junction is good. This part of the line from Rifle creek to Grand Junction, 54 miles, will be built under the charter of the Rio Grande Junction R. R. Co., recently incorporated.—It is stated that a line from Lehi City, Utah, to Tintic is under consideration.

Northern Pacific.—About 25 miles of the line from Missoula to Mullen, 125 miles, have been located and 35 more will soon be finished. Surveys will commence for a line from Pony to Red Bluff, Mont., to connect with the Gallatin-Butte branch. Forty miles of the line from Ft Benton to Billings have been located and surveys are now in progress on the remainder. It is stated that construction will soon commence on the Elkhorn branch.—It is reported that the company will float a loan of $15,000,000 to be used in making improvements on its Pacific coast terminal property.

Seattle & Northern.—Work has been commenced on this road from Ship Harbor, W. T., east. It is expected that about 40 miles will be completed this season. The company was incorporated in 1888 to build a railway from Seattle, via Whatcom and Blaine, up the Skagit river to Spokane Falls.

Seattle, Lake Shore & Eastern.—Good progress is being made on the locating surveys for the northern branch of this road. The greater part of the route from the Skagit river north runs through a dense forest.

Oregon Pacific.—J. S. Antonelle and Loring B. Doe, of San Francisco, who have the contract for constructing 20 miles of this road, including the Cascade tunnel, will commence work immediately. This will complete the road to the summit of the Cascade mountains. The company already has 4 miles of track laid at the summit of the mountains. Contracts for extending the road into eastern Oregon will be let before fall.

Atchison, Topeka & Santa Fé.—Arrangements have been made with the San Francisco & Northern Pacific R. R. Co., by which this company secures terminal facilities at Tilburon, on San Francisco bay.—Abundant press dispatches give us this item, but we are at a loss to understand what the Santa Fé wants of terminals at San Francisco, now or for a very long time to come.

Port Townsend & Southern.—This company asks subsidies of the people along the route sufficient to pay the interest on its bonds until the completion of the road. On condition of such subsidies being granted it promises to complete 25 miles of its road before July 1, 1890, and 25 miles each subsequent year.

Pacific Short Line.— The contract for grading 125 miles of the Salt Lake Valley & Eastern R. R. from Ogden, Utah, east to the Wyoming coal fields will be let about the middle of August. The contract for a 100-mile section east from the Wyoming coal fields will be let in September.

Atlantic & Pacific.—The business men of Albuquerque, N. M., have subscribed $75,000 in aid of the proposed branch to the San Pedro mining camps 40 miles east of Albuquerque.

Southern Pacific.—It is reported that the San Pedro, Los Angeles & Utah R. R., running from Raymond Station to Altadena, 7 miles, has been purchased by this company, and a connecting link, 3 miles long, will be built from Altadena to Raymond station.

Fairhaven & Southern.—The capital stock of this company has been increased $5,000,000. It is announced that an additional force will be put on and the road completed as soon as possible. About 25 miles of the grading out of Fairhaven has been completed and tracklaying is now in progress. The road is projected to run from the International boundary line to the Oregon State line, 250 miles. NELSON BENNETT, of Tacoma, W. T., is President and J. J. DONOVAN, of Fairhaven, W. T., is Chief Engineer.

Projects and Surveys.

Ellensburg & Northeastern.—Organized in Washington Territory with the following officers: President, JOHN A. SHOUDY; first Vice-President, THOMAS L. NIXON; second Vice-President, GEO. W. ELLIOTT; Secretary, J. C. LLOYD; and Treasurer, W. R. ABRAMS. It is stated that construction will begin at once.

Stockton, Fresno & Southern.—FREDERICK HOMER, of 212 Sansome St., San Francisco, Cal., sends us the following information concerning this enterprise:—

The road is to run from Stockton via Fresno and Centerville to Visalia, a distance of 175 miles. The locating surveys have been completed. The route is generally level; maximum grade 30 ft. per mile, and maximum curve 5°. There will be two bridges across the Merced and San Joaquin rivers, 6,000 ft. and 4,400 ft. respectively. The principal business of the road will be in grain, stock, mining supplies, and lumber. Nearly all of the right of way has been secured and about $150,000 local aid subscribed by the people along the route. This company was incorporated Aug. 11, 1888. HENRY S. DAVIS, 212 Sansome St., San Francisco, Cal., is President, and E. E. TUCKER, of Stockton, is Chief Engineer. Construction will probably begin July 15, 1889.

Columbia & Cascade City.—Incorporated in Washington Territory by AARON CHANDLER, ANTHONY M. CAMERON, GEO. K. STOCKER and others of Spokane Falls, to build a line of railway from Colville through the Kettle valley to a point on the British Columbia line.

Scio.—Chartered in Oregon to build a line of railway from Scio to Munkers. Among the incorporators are P. O. SMITH, A. J. JOHNSON, and EDWARD GOIN, of Scio.

Utah Western.—This company has been chartered in Utah to build a railway from Beck's Hot Springs to Monnahansett beach on Great Salt Lake, a distance of 30 miles.

Pitkin County.—Incorporated in Colorado to build a railway from Aspen via Tourtelotte Park and Richmond Hill to Ashcroft, with a branch via Hunter Park northeast. The officers are: H. A. W. TABOR, President; IRA W. PENDLETON, Vice President; L. M. BABCOCK, Secretary; and C. E. SHRIVER, Chief Engineer; all of Aspen.

FOREIGN.

Delagoa Bay.—The recent trouble arising from the withdrawal of the concession granted by the Portuguese Government to a company composed of English capitalists empowering it to build a railway across the province of Mozambique, South Africa, seems to be approaching an amicable settlement. The decree canceling the concession has been rescinded and all things point toward the reimbursement of the company for the loss sustained and the early resumption of work. The concession granted was for a road to run from a point on Delagoa Bay west across the Lobombo mountains to the eastern boundary of the Transvaal, a distance of about 60 miles. A greater portion of the road was opened for traffic some time ago, but a small and by far the most difficult portion to construct, through the Lobombo mountains, was not completed in the time stated by the concession. That it is not the intention of the company to finish this portion of the road is the plea upon which the withdrawal of the concession is based. The Portuguese Government, however, has never definitely located the frontier line.

Greece.—A press dispatch states that the contract for building a railway from Athens to Larissa has been let to an English syndicate. The line is to be completed in 5 years.

Palestine.—The preliminary surveys have been completed for the road which is projected to run from Jaffa, on the seacoast, to Jerusalem, Palestine, a distance of about 46 miles. A company composed of English and French capitalists has been formed to build the road, and engineers will soon start the locating surveys. The route is said to present some serious engineering difficulties.

Western Australia.—The Great Southern Ry., built by the West Australian Land Co., was opened for traffic on June 3. The line opens up through communication between Albany and Perth; it is 244 miles long from Albany to Beverly, where it joins the Government line. The contractors were C. & E. Millar, of Melbourne, Victoria, who commenced work in the fall of 1886. The locomotives have been furnished by Beyer & Peacock and Kitson & Co., and the cars by the Metropolitan Ry. Carriage Co., all English firms.

Chili.—It is expected that the 100 miles necessary to complete the Antofagasta Salitara R. R. to the Huuncha silver mines will be built by October. This road will, together with another line running from Buenos Ayres to Huancha, form the first South American transcontinental railway line.

Uruguay Northern.—This company has been organized to build a railway from Islade Cabellos, in Uruguay, to San Eugenio, on the Brazilian frontier, a distance of about 70 miles. The Government of Uruguay has subsidized the road to the amount of $295,000 per year for 40 years from 1885. The property of the road is free from direct taxes and import duty on construction material. Work is now in progress and it is expected to complete the line in about 20 months. The offices of the company are at 16 St. Helen's place, London.

Carenero.—This company is marketing an issue of $1,455,000 bonds to aid in the construction of a railway from the port of Carenero to San José, Venezuela. The Government will grant a subsidy amounting to 7 per cent. interest per annum on the sum of $3,300,000 for a term of 99 years from 1888.

RAPID TRANSIT.

Electric Railways.—***Brooklyn, N. Y.***—The Brooklyn Heights Ry. Co. has been granted permission to build a line on Montague St., from Court St. to the Wall St. ferry.

Auburn, N. Y.—The Auburn & Owasco Lake Electric Railway Co. has been incorporated by S. D. LAKE, W. S. WALES, and A. E. MATTHEWS, of Syracuse, BYRON C. SMITH and JOHN LANEHART, of Auburn and W. BENCH, of Owasco. Capital stock, $50,000.

Allegheny, Pa.—The North End Electric Passenger Ry. Co. has been organized by H. WALKER and JOHN RODGERS, of Allegheny; J. C. BARR, CHAS. ANDERSON, and J. B. CONWAY. Capital stock, $25,000.

Kansas City, Mo.—The East Side Street Ry. Co. has been organized. President, W. H. WINANTS. Engineer, W. B. KNIGHT. Capital stock, $250,000.

Denver, Col.—The University Park Ry. Co. has awarded the contract for construction to D. E. Rich & Son, at 10,25 and 80 cts. per cu. yd., for earth, loose rock and solid rock grading; $400 per mile for track laying; $2 each for setting poles. The contract for 30-lb. T rails has been let to T. S. White, of St. Louis. The Swem automatic switch, with steel frog, is used. The Thomson-Houston electric system has been adopted, and the road is to be completed by Aug. 15.

Cable Railways.—***Washington, D. C.***—The Washington & Georgetown Ry. Co. has awarded contracts as follows for its Seventh St. line: cable driving plant, Walker Mfg. Co., Cleveland, O.; two Reynolds-Corliss compound condensing engines, E. P. Allis & Co., Milwaukee; boilers, Babcock & Wilcox, New York; 7,200 regular yokes, 50 special yokes, and 1,030 manhole frames and collars, the Hose & Lyon Co., Dayton, O.; 9,000 bbls. of Portland cement, J. H. McGill, Washington.

Chattanooga, Tenn.—The Cameron Hill & Hotel Park Street Ry. Co. has awarded the contract for its street railway and incline railway to the Tennessee Building & Contracting Co., of Chattanooga; the contract for engines and machinery for the incline was awarded to G. W. Wheland.

Minneapolis, Minn.—The Minneapolis Street Ry. Co. has offered to put in a cable system on two of its lines.

Spokane Falls, W. T.—The South Side Cable Ry. Co. has been organized by J. D. SHERWOOD, F. R. MOORE, and others; A. S. MOORE, of San Francisco. Capital stock, $200,000.

Seattle, W. T.—The Front Street Cable Ry. Co. will build a line 3¼ miles long on Madison St. to Lake Washington. There will be two cables, a slow-speed line in the city and a high-speed one in the suburbs. The track will be 42 ins. gauge, with rails weighing 40 lbs. per yd. There will be 10 cars, each carried on two 4-wheeled trucks; they will be combination grip and passenger cars, seating 125 persons each.

Inclined Plane.—The Kansas City Inclined Plane Railroad Co., which proposes to build an elevated line 500 ft. long to connect the upper and lower parts of the city, will let contracts for construction as soon as the city grants permission. It will be an iron trestle structure, with a grade of 42 per cent., and all the right of way has been purchased. There will be two tracks of 11 ft. gauge, on each of which will be a large car, with a horizontal platform carrying 4 teams in addition to foot passengers; the capacity of the cars is 20 tons. The cars will be hauled by a 3-in. steel cable, with a duplicate safety cable, running slack. The power house will be at the summit. The entire plant will cost about $200,000. Chief Engineer, S. DIESCHER, of Pittsburg, Pa.; Manager, L. C. IRVINE, of Kansas City.

Street Railways.—***New York, N. Y.***—The Metropolitan Cross-Town Ry. Co. has applied to the aldermen for permission to build a line from Grand St. to 14th St. A. B. STONE is President.

Montgomery, Ala.—The Montgomery Terminal & Street Ry. Co. has been incorporated. President, IGNATIUS POLLAK; Vice-President, J. D. ROQUEMORE; Treasurer, G. W. CRAIK; Secretary, R. C. MITCHELL.

Lancaster, O.—A line 8,867 ft. long is to be built. Proposals for work complete, or separately for materials and grading, will be received until July 28 by FRANK BARRETT.

Kalamazoo, Mich.—The U. S. court has ordered the sale in chancery of the street railway, to satisfy a mortgage and interest of $106,900, due the Central Trust Co. of New York.

CONTRACTING.

Granite Blocks.—The following were the bids received in June by CHARLES D. JACOB, Mayor, Louisville, Ky., for 30,000 tons of granite blocks: Scott Newman, Jr., Louisville, Ky., $7.03 per ton; W. F. Harris, Louisville, $7.15; Maine & New Hampshire Granite Co., $7.40; Winnsboro Granite Co., South Carolina, $7.40; M. E. Maher, Stockbridge, Ga., $7.43; A. V. Gude, Louisville, $7.91; R. F. Wilson, Little Rock, Ark., $8.39; Horace Scott, Louisville, $6,90 (informal). The contract was awarded to Scott Newman, Jr., at $7.03 per ton of 2,240 lbs.

Pipe.—***Rochester, N. Y.***—The contract for 15 net tons of 12-in. cast iron pipe, 67 tons of 10-in., 135 tons of 8-in., 352 tons of 6-in., 56 tons of 4-in., and 33,000 lbs. of special castings has been let by the Executive Board to the Buffalo Cast Iron Pipe Co., of Buffalo, at $24.50 per ton for pipe and 2½ cts. per lb. for castings.

Nasheville, Tenn.—The contract for the 36-in. main from the new reservoir, aggregating about 1,940 tons, including specials, has been awarded to Dennis Long & Co., of Louisville, Ky., at $23,95 per ton.

Rock Excavation.—The following proposals were opened June 20 by Lieut.-Col. W. E. MERRILL, U. S. Engineer Office, Cincinnati, O. Rock excavation at Brooklyn Ill.: H. S. Brown, Quincy, Ill., $1.10 per ton; Crescent City Wrecking Co., New Orleans, La., $6; Bauer & Kluge, Golenda, Ill., $7; I. V. Hoag, Jr., Pittsburg, Pa., $12.75. Removing part of rock bar at the mouth of the Licking river: J. T. King, Belpre, O., $3,97½ per cu. yd. by use of coffer-dam; Folz & Jonte, Cincinnati, O., $4.25 by submarine blasting, $4.50 by coffer-dam; Crescent City

Wrecking Co., New Orleans, La., $7.50 by blasting; Shipman & Richardson, Portsmouth, O., $9 40 by coffer-dam; Kirchner & Scally, Cincinnati, O., $9.50 by coffer-dam; Willard Johnson, Fulton, N. Y., $9.50 by blasting, $10 by coffer dam; I. V. Hoag, Jr., Pittsburg, Pa., $12.75 by blasting, $14.70 by coffer-dam.

Iron Columns.—The following proposals have been received by the Board of Capitol Managers, at Denver, Col., for 122 iron columns for the Colorado State Capitol building: W. J. Godfrey & Co, Denver, $13,450; Lane Bridge & Iron Works, Chicago, $13,888; Geddes & Seerie, Denver, $15,500; Colorado Iron Works, Denver, $15,900; Paxton & Vierlung Architectural Iron Works, Omaha, $20,460.

Granite.—The following proposals have been received by Capt. B. C. GREENE for granite for the walls of the Congressional library at Washington, D. C.: Mt. Waldo Granite Co. and Hallowell Granite Works, Me, (joint bid); $1,417,054 for Hallowell granite, $1,349,744 for Mt. Waldo granite, $1,512,054 for Clark Island granite; New England Granite Works, Hartford, Conn., $1,221,600; Dadlin Granite Co., Waterville, Me., $1,416,823; William H. B. Stout, Lincoln, Neb., $1,556,076; Cape Ann Granite Co. Boston, $1,076,682; Gilford & Waterville Granite Co., Baltimore, $816,322; Westham Granite Co., Richmond, $1,356,928.

Sewers.—*Poughkeepsie, N. Y.*—The following proposals were received July 2, for laying sewer pipe. The contract was awarded to Kiernan & Lawlor, of Poughkeepsie. Mr. CHAS. E. FOWLER is Superintendent.

Bidders.	Rock excavation, 1700cu.yds. percu. yd.	Laying 24-in. pipe, 700 lin.ft. per ft.	Laying 22 in. pipe, 800 lin.ft. per ft.	Laying 12-in. pipe, 160 lin ft. per ft.	14 manholes, each.	6 silt basins, each.	Total.
Brennan & Ryan, New York City	$5.00	$2.00	$2.00	$1.50	$65.00	$150.00	$13,050.00
Sullivan & Co., Little Falls, N. Y.	2.50	2.40	2.20	1.50	175.00	300.00	12,130.00
C. Daley, Poughkeepsie, N. Y.	4.00	2.25	2.25	.75	54.50	117.80	11,764.80
Holmes & Cogan, Jersey City, N. J.	4.50	1.40	1.40	1.00	50.00	120.00	11,330.00
P. H. Ward, Poughkeepsie, N. Y.	3.50	2.15	2.12	.15	46.00	130.00	10,509.00
Chas. Cooke, " "	4.50	.70	.30	.20	45.00	130.00	9,822.00
John McNulty, " "	4.50	.50	.50	.20	45.00	125.00	9,812.00
Kiernan & Lawlor " "	4.00	.50	1.00	.30	40.00	120.00	9,278.00

Sewers and Sewer Pipe.—*Ware, Mass.*—The following proposals for building about 6 miles of pipe sewers have been received by the Road Commissioners: M. Sullivan & Co., Little Falls, N. Y., $19,494; E. E. Eglee & Co., Flushing, N. Y., $20,840; T. Wm. Harris & Co., New York, $23,231; Neil McBride, Brighton, Mass., $23,644; Dennis O'Connell, Boston, Mass., $23,960; Geo. M. Atkins & Co., Palmer, Mass., $24,699; National Construction Co., Boston, Mass., $25,041; Brennan & Ryan, New York, $25,503; Chas. B. Cadwell, New Britain, Conn., $27,285; Franklin A. Snow, Providence, R. I., $30,314; Metropolitan Construction Co., Boston, Mass., $31,702; Henry H. Pike, Cambridge, Mass., $36,370; F. E. Shaw, Providence, R. I., $37,157; Geo. Jepson, Boston, Mass., $50,040. The contract has been awarded to M. Sullivan & Co. The contract for 1,500 ft. of 15-in. Akron sewer pipe, 1,850 ft. of 12-in., 2,180 ft. of 10-in., 2,630 ft. of 9-in., 12,630 ft. of 8-in., and 12,630 ft. of 6-in. pipe, has been awarded to Marsh Bros. and F. D. Marsh, of Ware.

Eau Claire, Wis.—The following proposals have been received by the Sewer Committee: John W. Haran, $19,492.17; Geo. H. Randall, $20,360.40; Thomas Reilly, $25,180.25; Ellis & McCann, $25,312.36; Eau Claire Plumbing & Construction Co., $25,360.22; Webster & Hawes, $25,631; Henry Laycock, $25,820.69. The City Engineer's estimate was $25,183.60. The contract was awarded to John W. Haran. The work consists of 1,700 lin. ft. of 34-in. brick sewer, 600 ft. of 24-in. pipe, 600 ft. of 18-in., 2,768 ft. of 15-in., 3,700 ft. of 12-in., 287 ft. of 9-in., and 2,200 ft. of 8-in.; also 76 catch basins, 50 manholes, connections and lamp holes. CHAS. F. BUSSELL is City Engineer.

Dredging, Removing Rock and Piling.—The following proposals for dredging in the Penobscot river, Me., between Bucksport and Winterport, were received July 2, by Lt.-Col. JARED A. SMITH, U. S. Engineer Office, Portland, Me.: Joshua R. Johnson, Wilmington, Del., 17 cts. per cu. yd., scow measure, for dredging; Thomas Symonds, Leominster, Mass., 35 cts.; Robert Hamilton, Chebeague, Me., 22 cts. for dredging, $12 for removing rock measuring more that 1½ cu. yds.; Moore & Wright, Portland, 24 cts., $15.

The following proposals for dredging and placing fender piles in St. John's river, Del., were received June 21 by Gen. W. F. SMITH, U. S. Engineer Office, Wilmington, Del.: F. C. Somers, Camden, N. J., 18 cts. for dredging, $8 per running ft. for piles. American Dredging Co., Philadelphia, 18¾ cts., $9; Atlas Dredging Co., Wilmington, Del., 20 cts., $10; Ira C. Lunt, New Castle, Del., $9.40 for pine piles and wales, $6,90 for pine piles and oak wales, and $9,90 for oak piles and wales.

The following proposals have been received by WM. SHANAHAN, Superintendent of Public Works, Albany, N. Y., for dredging 32,000 cu. yds. in the Hudson river: E. M. Payn, 13.8 cts. per cu. yd: P. J. Brummelkamp, 14½ cts.; E. R. Seward, 20 cts. For dredging 15,000 cu. yds. at Troy: P. J. Brummelkamp, 30 cts.; P. W. Myers, 34½ cts.; E. R. Seward, 36 cts.; E. M. Payn, 39 cts. The contract for work at Buffalo has been awarded to Hingston & Wood, of Buffalo, at 11½ cts. per cu. yd., for dredging in Black Rock Harbor, 16 cts. for dredging in the Ohio basin, and $5.25 for removing rock in Bird Id. channel.

PROPOSALS OPEN.

Street Work.—Grading and brick paving in Districts 2 and 3. THE BOARD OF PUBLIC WORKS, Nebraska City, Neb.

City Work.—Grading, paving, curbing and sewers. E. M. BIGELOW, Chief of Department of Public Work, Pittsburg, Pa. July 17.

Dredging.—In Hudson river. About 16,000 cu. yds., at New Baltimore, 18,000 cu. yds. at Mull's Light, and 9,000 cu. yds. at Parda Hook. JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y. July 17.

Dredging.—Between Piers 41 and 42, North river. THE DOCKS COMMISSIONERS, Pier A, North river, New York City. July 17.

City Work.—Brick, cedar block, or cypress block paving; on concrete, broken stone or plank foundation, and with stone, cement, or iron curbing. Also 12-in. pipe sewer. THE BOARD OF PUBLIC WORKS, Des Moines, Ia. July 18.

Water-Works.—Proposals for wells and works together or separate. A. B. CARR, Bryan, Tex. July 22.

Road and Grading.—Road about 46,000 ft. long; 35,000 cu. yds. of graveling and grading. Capt. A. H. YOUNG, U. S. A., Newport, Ky. July 24.

Railway.—Grading, masonry and trestles on 50 miles. R. H. TEMPLE, Chief Engineer, Georgia, Carolina & Northern Ry., Chester, S. C. July 27.

Sidewalks.—About 50,000 sq. ft. or flagging of artificial stone, and 45,000 sq. ft. of brick sidewalk. GEO. E. POND, Asst. Q. M., U. S. A., Fort Riley, Kan. July 27.

Street Railway.—Materials and construction for a line 8,867 ft. long. FRANK BARRETT, Lancaster, O. July 28.

Canal Locks.—Lengthening locks, Nos. 23, 24, 25, 26, 65, and 66, on the Erie canal; locks Nos. 9 and 10, on the Oswego canal; and also for rebuilding lock No. 12 on the Black river canal. The work must be completed by April 20, 1890. JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y. July 30.

Canal.—Repairing and restoring between Cumberland and Georgetown. S. GAMBRILL, President, Chesapeake & Ohio Canal Co., Georgetown, D. C. August 1.

Railway.—Grading, tunneling, masonry and trestling on 57 miles. J. H. PEARSON, Chief Engineer, Richmond, Nicholasville, Irvine & Beattyville Ry., Nicholasville, Ky. August 5.

MANUFACTURING AND TECHNICAL

Dredge.—A second-hand dredge, suitable for shallow water, is wanted. Address P. O. Box D, Pensacola, Fla.

The Lidgerwood Mfg. Co., 96 Liberty St., New York, has found it necessary, owing to the steadily increasing demand for hoisting machinery, to establish a western branch house, and has opened an establishment at 34 & 36 W. Monroe St., Chicago, Ill., where a large stock of the latest improved machines adapted for all hoisting purposes will be carried. Mr. W. L. PIERCE, Secretary of the company and general manager of the New York headquarters, has gone to Europe for two months.

W. S. Payne & Co., of Fostoria, O., have not gone out of business as has been stated, but are still manufacturing tapping machines and water-works supplies.

Graphite and Acid.—An experiment was made recently at the Joseph Dixon Crucible Co.'s laboratory at Jersey City, N. J., in which a piece of iron 2in. x ⅛-in. and 10 ins. long, with one half of the surface painted with Dixon's silica graphite paint and the other half unpainted, was suspended for several days in a bath of dilute sulphuric acid, much stronger than any sulphur water met with in mining. The painted part was not damaged, while the unpainted part was eaten away to about half its original bulk. The experiment showed the ability of this paint to withstand the acid, and its usefulness, particularly in mining, where iron pipe is laid in sulphur water.

Gauges.—The Brown & Sharp Mfg. Co., of Providence, R. I., issue a circular descriptive of a center gauge and gauge for grinding and setting screw tools; the gauge is marked with a table for determining the size of tap drills. The price is 25 cts.

Filters.—The National Water Purifying Co., of New York, reports contracts for converting to its system $20,000 worth of Roeske filters in Philadelphia.

Turnbuckles.—Carnegie, Phipps & Co., of Pittsburg, have recently commenced the manufacture of pressed wrought-iron turnbuckles, 1 in. to 1½ in. and other sizes. They are adapted for railway, bridge, car and general work.

Drilling.—The Ingersoll-Sergeant Rock Drill Co., of New York, gives a report of drilling with a 3½-in. drill in hard limestone, as follows: From May 6 to May 20, both inclusive, 10 hours run each day, with 4 hours lost time during rain storm, 5,208 holes were drilled, each 1 in. in diameter by 7 ins. deep On June 6, 10 hours run, including all stops, moving about, etc., 527 holes, also 1 in. diameter by 7 ins. deep, were drilled.

Locomotives.—The Schenectady Locomotive Works, of Schenectady, N. Y., have sent out 2 ten-wheel engines to the Fairhaven & Southern Ry., in Washington Territory.

The Rhode Island Locomotive Works, of Providence, R. I., have delivered a 45-ton mogul engine to the Cheshire Ry., in New Hampshire.

Railway Material and Equipment.—Light rails, dummy engines and cars for a street railway are wanted by Samuel Tuggle, of Sulphur Rock, Ark.

Rails, passenger and freight cars for a street railway are wanted by R. L. Bennett, of Tallahassee, Fla.

About 10 miles of 24 to 32-lb. iron or steel rails, new or second hand, spikes and fastenings, light engine and cars, are wanted by E. J. Payn, of Little Rock, Ark.

Locomotives and cars for lumber hauling are wanted by C. H. Plummer, of East Saginaw, Mich.

Cars are wanted by the Cameron Hill & Hotel Park Street Ry. Co., of Chattanooga, Tenn.

Lumber.—The Nicaragua Canal Co., of New York, will soon place orders for 1,000,000 ft. B. M. of yellow pine lumber.

Railway Supplies for Hawaii.—Railway supplies are wanted for the lines in Hawaii. Manufacturers and dealers are invited to send catalogues and price lists to SAMUEL G. WILDER, President of the Hawaiian Ry. Co., at Honolulu.

Car Works.—The Mexican National Ry. Co. will build extensive machine shops and car works at Laredo, Tex., at a cost of $600,000. The buildings will be of brick, with iron roofs.

Granite.—The Booth Bros. & Hurricane Isle Granite Co., of New York, is supplying the granite work for the Rouss Building, 549-553 Broadway, and has contracts for the State House at Augusta, Me., the court house at Fall River, Mass., and the U. S. building at Key West, Fla.

BRIDGES AND CANALS.

Bridge Notes.—*Brunswick, Me.*—The selectmen have awarded the contract for building an iron span to the Androscoggin bridge on the Brunswick side to the King Iron Bridge & Mfg. Co., of Cleveland, O. The present wooden approach will be replaced by an iron truss 90 ft. long, 22 ft. roadway and 6 ft. sidewalk.

Holyoke, Mass.—The Berlin Iron Bridge Co., of East Berlin, Conn., has the contract for the canal bridge at Dwight St., for $15,000. The bridge will have 3 spans instead of 2 and there will be 4 iron piers resting on stone foundations, the top of which will project about 4 ft. above the water level. The roadway will be paved with granite blocks set in concrete, with a grouting of tar.

Nassau, N. Y.—The Town Board will spend $1,600 on 2 new iron bridges at Hoag's corners.

Clifton Park, N. Y.—The Highway Commission have awarded a contract for 3 stone arch bridges to Henry Clark, at $2,650.

Scottdale, Pa.—The Commissioners of Fayette and Westmoreland counties will build a bridge over Jacobs creek, at Claire Mills, 4 miles from the city.

Lewisburg, Pa.—The Lewisburg Bridge Co. will receive bids until July 25 for the superstructure of a bridge to replace the one destroyed by the June floods. It will be a wooden Howe truss bridge, for railway and wagon traffic, and there will be 5 spans of 150 ft. D. BRIGHT MILLER is President.

Bradford, Pa.—The contract for the masonry of the Kennedy St. bridge has been awarded to S. B. Palmer, of Stroudsburg, at $1,958. The contract for the iron superstructure was let to the Wrought Iron Bridge Co., of Canton, O., at $2,227 for a Pratt truss of 80 ft. span with 2 walks 6 ft. wide. J. A. SEYMOUR is City Engineer.

Chattanooga, Tenn.—The County Court has awarded a contract for a steel bridge across the Tennessee river, at about $225,000.

Monticello, Miss.—The contract for the iron bridge over Pearl river has been awarded to the Columbus Bridge Co., of Columbus, O., at $16,240. The bridge will have a draw and will be 250 ft. long; the total length, including timber approaches, will be 350 ft.

St. Charles, Mo.—The Cleveland, St. Louis & Kansas City Ry. Co. will build a bridge over the Missouri at this place.

Milwaukee, Wis.—The ordinance has been passed authorizing the construction of a bridge connecting Michigan St. with Sycamore St. and the Northwestern and St. Paul depots.

Muscatine, Ia.—The Milwaukee Bridge & Iron Works, of Milwaukee, Wis., have a contract for an iron bridge over the Mississippi; it will have 10 spans of 200 ft. and 1

channel span of 402 ft.; roadway 28 ft. wide, with 1 sidewalk. Contract price, $249,000.

Minneapolis, Minn.—MR. FOX, C. E., has submitted to the County Commissioners plans and specifications for the proposed Minnesota river bridge at Bloomington Ferry. The plans provide for a 275-ft. drawbridge to cost about $30,000, but if the Board will allow him time, he will prepare plans for what he considers a more desirable bridge with 250-ft. draw and an extra span of 100 ft.

Denver, Col.—The following proposals have been received by A. M. VAN AUKEN, C. E.: Kansas City Bridge & Iron Co., Kansas City, Mo., $6,480, $6,894, $7,230; Wisconsin Bridge & Iron Co., Wauwatosa, Wis., $7,200, $7,600; W. E. Stearns & Co., Leavenworth, Kan., $7,150; H. L. Aull, Denver, $7,976, $8,474; H. C. Jennings, Denver, $8,893.50; George E. King Bridge Co., Des Moines, Ia., $8,993; Missouri Valley Bridge & Iron Co., $8,907, $9,881, $10,085, $10,706; Fair Williams & Co., Ottumwa, Ia., $10,725; Bullen Bridge Co., Pueblo, Col., $11,875; P. E. Lane, Chicago, Ill., $10,450, $12,600. The County Commissioners have received the following bids for the construction of the Littleton and Petersburg bridges: For the former bridge, which will be 132 ft. in length, the following are the bids: D. D. Whitelock, $2,670; W. E. Edorn, $1,150; J. Williams, $1,800; T. J. Grant, $8.90 per lin. ft.; R. Jackson, $8.87 per lin. ft. The Petersburg bridge is to be 220 ft. in length. The bids are as follows: D. D. Whitelock, $4,630; W. E. Edorn, $1,850; J. Williams, $2,950; T. J. Grant, $8.90 per lin. ft.; R. Jackson, $8.87 per lin. ft.

Guthrie, Okla.—A bridge has been built across the Cottonwood river, between Guthrie and West Guthrie. Mr. Gillespie designed and built the structure.

The Pennsylvania Railroad is having the piers and foundations of its river bridges examined by a diver.

The Texarkana & Northern Railway will build an iron bridge over the Red river. The contract has been awarded to the Missouri Valley Bridge & Iron Works, of Leavenworth, Kan., at $120,000.

Viaducts.—***East St. Louis, Ill.***—The special committee, of which Mr. D. C. MARSH is chairman, appointed to find out the cost of building a viaduct over the railroad tracks on Broadway, has submitted a report to the Council, favoring the construction. The structure will be of steel, with plate girder spans, steel lattice posts, with a broad rock foundation. The cost of the structure will be about $70,000, the larger portion of which will be borne by the railroad companies whose tracks it will span. The Council has ratified the report.

Kansas City, Kan.—The Council has received the following bids for the construction of the viaduct across the Union Pacific tracks at Armstrong: Detroit Bridge & Iron Works, $77,250; King Iron Bridge & Mfg. Co., $71,000; George E. King Bridge Co., $73,600; T. E. Lane, $60,000; Missouri Valley Bridge & Iron Works, $69,733; Kansas City Bridge & Iron Works, $69,450; Wrought Iron Bridge Co., $70,000; Mount Vernon Bridge Co., $79,800; Horace A. Keefer, $78,400. The structure will be 1,700 ft. long and 32 ft. wide. The contract was let to the Kansas City Bridge & Iron Co., at $69,450, $534 below the engineer's estimate.

Denver, Col.—The city has appropriated $10,000 towards the cost of the 14th St. viaduct, work on which is now under way. The Milwaukee Bridge Co. has the contract for the iron work.

ELECTRICAL.

New York City.—The following preposals were recently received by the Gas Commission:

	No. lamps.	*Price. (cents.)*	*Remarks.*
U. S. Illuminating Co. ...	282	25	
U. S. Illuminating Co.....	176	29	
U. S. Illuminating Co.....	334	35	
Brush Electric Ill. Co.....	371	35	
Brush Electric Ill. Co	70	45	On subways.
East River El. Light Co...	387	35	
East River El. Light Co...	21	44	On subways.
Mt. Morris El. Lt. Co.....	378	20	
Mt. Morris El. Lt. Co	139	21	
Mt. Morris El. Lt. Co.....	72	22	
Mt. Morris El. Lt. Co.....	94	23	
Mt. Morris El. Lt. Co	32	24	
Mt. Morris El. Lt. Co.....	22	25	
Harlem Lighting Co.....	49	35	
Harlem Lighting Co.	16	44	On subways.
Harlem Lighting Co	19	50	Mt. Morris Park.
Harlem Lighting Co.....	2	60	Harlem Bridge.
North N. Y. Lighting Co..	26	40	
North N. Y. Lighting Co..	3	60	Harlem Bridge.

The prices on the bids, which were rejected on June 17, were: Brush Co., 35 cts., and subways 65 cts.; East River, 35 cts., and subways 68 cts.; United States Co., 35 cts.; Mount Morris Co., 25 cts., and subways 55 cts.; Harlem Co., 35, 50, and 60 cts.; North New York Lighting Co., 35 cts. The bids of the Mount Morris Co. included the lamps now lighted by the East River, United States, and Brush companies, in the upper portion of the city, and the United States Co. bid for many of the lamps now lighted by the East River Co.

Electric Light.—***Schenectady, N. Y.***—The Mohawk Valley Electric Co. has been incorporated by WM. J. SCHERMERHORN, FRANCIS H. LEONARD and J. A. VANVORST. Capital stock, $200,000.

Hamburg, N. Y.—A new land company proposes to put in an electric light plant. Mr. VAN ETTEN, Superintendent of the New York, Lake Erie & Western Ry., is intereste d.

West Orange, N. J.—The Township Committee has made a contract with the Essex County Electric Light Co. for 37 lamps at $100 per lamp.

Lexington, Ky.—The Citizens' Electric Light & Power Co. has been incorporated. President, G. A. DELONG; Secretary, W. H. POWELL. Capital stock, $100,000.

Lansing, Mich.—The Council has made a contract with the electric light company at $100 per light per annum; the light to burn all night and every night.

Metropolis, Ill.—The Metropolis Electric Light Co. has been incorporated by WM. R. BROWN, WM. S. THOMAS and WM. O'TOWLE. Capital stock, $10,000.

Joliet, Ill.—A special committee is making an investigation of the systems of the several companies which have submitted propositions for electric lighting.

Taylorville, Ill.—The council has awarded a contract to C. C. Travis, of Chicago, to put in a Thomson-Houston incandescent system. The city will take 80 lights of 16 c. p. and 20 of 32 c. p. for 5 years, at $1,380 per year.

Hyde Park, Ill.—The Hyde Park Thomson-Houston Light Co. has been organized at Chicago by B. E. SUNNY, MONROE L. WILLARD and A. A. BLISS. Capital stock, $100,000.

San Jose, Cal.—The San Jose Light & Power Co. has been incorporated by C. T. RYLAND, AMASA EATON and E. W. CLAYTON. Capital stock, $100,000.

WATER AND MUNICIPAL.

Dams.—The New Sharon Dam Co., of New Sharon, Me., will build a dam across the Sandy river. R. W. Weid is the contractor.——The dam of the Deerfield River Co., at Sadawga, Vt., has been examined by an engineer, and declared unsafe.——At Fresno, Cal., Moore & Smith are building a large dam on Mill creek, to form a reservoir of about 100 acres area, with 10 ft. of water.——A. C. MOORE, C. E., of Southbridge, Mass., has prepared plans and specifications for a new dam for Akers & Taylor, to replace one washed out last spring. It will be 20 ft. long by 16 ft. high.——Near Townsend, Mont., a dam is being built to make a reservoir to supply water for the Irish irrigation ditch.

Sewage Disposal.—At Santa Rosa, Cal., the Common Council has decided to establish a "sewer farm," to be located several miles southwest of the town. The plan of sewering to tide-water in Petaluma creek was abandoned, on account of the large expense which it would necessarily entail, and in the opinion of sanitary engineers, the adopted scheme will be satisfactory. The sewage, being collected, will be deodorized and decomposed, and hauled away for the purpose of fertilization. The action of the Council will probably cause the settlement of a suit brought against the city, on account of alleged damage from the former system, which emptied the refuse matter into Santa Rosa creek.

Wells.—The Health Board of Indianapolis, Ind., has had an investigation made of the condition of the wells along the streets in the heart of the city, and Mr. HURTZ, chemist, has reported that those examined have been badly contaminated from the sewers, and from vaults at residence properties, and the health of the city requires that they shall be condemned. He gives instances of the kind and extent of the contamination, and declares that all of the fever now prevalent in the city is traceable to the bad water. In some instances the wells at private residences have been sunk but a few feet lower than the dry wells connected with the closets and bath-rooms, and the water is in constant use for domestic purpose. The Board will probably order a wholesale condemnation of private and public wells.

Water Power.—The Buffalo & Niagara Water Power & Drainage Co., of Buffalo, N. Y., will shortly organize for business. The capital stock is $5,000,000. Work is to be begun in 3 years. Mr. D. B. LONG, of Williamsville, is the engineer, and the following are the trustees of the company: JAMES ADAMS, EUGENE A. GEORGER, CHARLES M. MORSE, EDGAR B. JEWETT, DANIEL B. LONG, TOBIAS B. STALEY, FREDERICK BUSCH, JOSEPH B. YOUNGS, and L. VAN ALLEN.

Artesian Wells.—***Allegheny, Pa.***—Proposals received by the Park Committee for putting down four artesian wells in the parks varied from 29 cts. to $1.50 per ft. some bidding on the boring only, and others including casing, pumps, and everything complete.

Savannah, Ga.—A new well is to be put down for the water-works; it will be about 1,500 ft. deep. The present wells are 6 and 9 ins. diameter and about 300 ft. deep.

Columbia, Ala.—The well put down by Mr. Herrington for the Town Council is about 540 ft. deep, cased for 512 ft.; the water only rises to within 12 ft. of the top.

Ackley, Ia.—The artesian well has been put down to a depth of 1,375 ft.

Gordon, Dak.—Artesian wells are projected, to furnish a water supply.

Richfield, Kan.—Artesian wells have struck a supply of water at a depth of 650 ft.; the water rises to the surface.

Ogden, Utah.—The Ogden Artesian Well Co. has completed another well on a tract of land belonging to Mr. C. R. REED, 2 or 3 miles south of Plain City. At a depth of 380 ft. a considerable flow of water was struck. The pipe is 9 ins. diameter.

Ormond, Fla.—P. J. Constantine will put down wells on a new estate.

Winnipeg, Man.—Mr. H. N. RUTTAN, City Engineer has presented his report for the year ending April 30, including a general report on the subject of draining the lands surrounding the city. There are 81.20 miles of graded streets, 8.5 miles of paved and planked streets, and 114.52 miles of sidewalks. The total length of sewers and flumes is 20.38 miles, with 40 flush tanks, to 30 of which water is now laid on. The surface drainage in some parts of the city is very imperfect.

Brooklyn, N. Y.—Mr. ROBERT VAN BUREN, City Engineer, has presented to Commissioner ADAMS his annual report. He adheres to the Grand Ave. plan for relief sewers, and estimates the cost of the improvement as follows: Greene Ave, main from Amity St. outlet to Marcey Ave. and branch to Halsey St., $1,150,000; raising the Flushing Ave. and Throop Ave. flooded district, $650,000; engineering and contingencies, $100,000; total, $1,900,000.

Aberdeen, Dak.—The sum of $43,000 has been expended to secure sewerage, and the success of the plans carried out is due to the artesian wells, which are very powerful in the James River valley. A 12-in. well was sunk in the southeastern portion of the city, and a pressure of 180 to 200 lbs. obtained. A reservoir was sunk near the well, and into this the sewers from the city lead, the fall being ample but moderate. Twice each day the motor, run by the artesian well, pumps the sewage from the reservoir up to a large sewer, about 40 ft. higher which leads directly into a slough ½ mile distant. The only expense attendant is the pay of a watchman for attending to the water motor twice each day. The artesian wells supply the city with water for fire protection and are available for almost unlimited manufactories.

Filters.—An Oliphant filter plant of 10,000,000 or 15,000,000 galls. daily capacity is proposed to be put in at New Orleans, La.

Water-Works.—***Maine.*** Belfast. The Water Co. recently completed its organization for the year and elected C. F. PARKS, President; C. BAKER, Clerk.

Massachusetts.—Marblehead. The town has contracted with the water company to supply water during July, August, and September at $300 per month and at $250 per month thereafter.——Malden. It is proposed to issue $25,000 in bonds to lay a high-service pipe.

New York.—Hamburg. The Hamburg Water & Electric Light Co. has filed articles of incorporation. Capital stock, $12,500. Trustees, E. VAN ETTEN and D. N. LOCKWOOD, of Buffalo.——Olean. The new 3,000,000-gall. pump, from the Holly Mfg. Co., Lockport, N. Y., has been put in service.——Brockport. Bids for water-works from Bassett Bros., Buffalo, N. Y., and Hanover & Morgan are now under consideration.——Syracuse. Engineers J. J. R. CROES, of New York, and HOWARD SOULE have been engaged to make a detailed report to the water commissioners on the Skaneateles and Otisco lake scheme.—— Brooklyn. The Board of Aldermen has authorized the laying of a new 16-in. water main from Prospect Hill reservoir to Brooklyn Heights, at a cost not to exceed $30,000.

New Jersey.—Mt. Holly. Works will be built at once, all of the new stock having been taken.——Summit. The Commonwealth Water Co. will build works to cost about $60,000. The supply will be taken from wells.

Pennsylvania.—Reynoldton. It has been decided to issue $10,000 of bonds for laying mains through the streets. The supply will be taken from the McKeesport reservoir.——Chartiers, Crafton, Mansfield. Water companies have been chartered. The shareholders are: G. C. HAMILTON, Jr., A. KENNEDY, and W. R. SEWELL, of Allegheny City, and J. W. MCCREEDY and A. J. MCQUITTY, of Mansfield.——Germantown. A sub-committee has been appointed by the Water Supply Committee to make investigations as to the quality and quantity of the present supply and additions which may be required.

Virginia.—Radford. Surveys are reported as being made. Address the Radford Land Co.——Petersburg. The Common Council has appropriated $10,000 for building dams and repairing the reservoirs.

North Carolina.—Raleigh. The Raleigh Water-Works Co. will probably put in a new 1,000,000-gall. filter.

Georgia.—Newnan. A bill is to be introduced in the Legislature to authorize the issuing of bonds.——Florence. The contract has been awarded to Jeter & Boardman, Macon, at $250,000. Work is to begin at once.

Alabama.—Sheffield. Bids will be opened by the Sheffield Water Co. on July 20. President, W. L. CHAMBERS; Secretary and Treasurer, J. ALLEN.

Mississippi.—Vicksburg. The additional pump to be put in by the Vicksburg Water Supply Co. will have a daily capacity of 1,000,000 galls.

Louisiana.—Shreveport. A filter is to be added. The works have been purchased by the First National bank of New York.

Kentucky.—Mayfield. The Mayfield Water & Light Co. has contracted to furnish the city with water and lights for 25 years, at $2,400 per year. The erection of water-works will be begun soon.——Stamford. Vandervoer & Miller are investigating the cost of erecting water-works. Address W. WALSH.

Ohio.—London. Proposals will be received until July 26. Address W. FERGUSON.——Wilmington. A twenty years' contract for water-works has been signed with JOHN P. MARTIN, of Xenia, O. The town will pay $5,000 yearly for 100 hydrants, and $35 for each additional hydrant. A stand-pipe will be erected.

Indiana.—Indianapolis. A syndicate of Chicago and Eastern capitalists has employed an engineer to inspect probable sources of supply, and make an estimate of the cost of a new system of water-works.

Illinois.—Venice. The Village Board has accepted the new water-works and paid $10,000 on account. The completed works will cost about $14,000.——Washington Heights and Calumet. An ordinance for a franchise to construct intake cribs in Lake Michigan, connect therewith tunnels, and build pumping works to furnish water to these towns, has been presented to the Common Council of Hyde Park by L. H. BISBEE, D. T. HARRIS, C. F. COFFIN, F. H. WATRISS, and ROBERT PIERSON. They are willing to give a bond of $100,000 to the city as indemnity against damages.

Wisconsin.—Antigo. Water-works are being discussed. Address the City Clerk.——Wauwatosa. The Wauwatosa Water Supply Co. has let a contract for a well 2,000 ft. deep, to Gray Bros., of Milwaukee, who have taken a quarter interest in the enterprise.

Nebraska.—Tekamah. A vote will be taken July 19, on the question of issuing $15,000 of bonds.

Montana.—Helena. Articles of incorporation of the Helena Consolidated Water Co. have been filed by GEO. F. WOOLSTON and others. Capital stock, $1,500,000.

Arkansas.—Eureka Springs. Water-works are wanted Address Z. B. FREEMAN.——Brinkley. Works are projected. Address J. T. SPRING.

Texas.—Greenville. The $100,000 system of water-works has been completed.

California.—Vacaville. A company with a capital stock of $18,000 has been formed. Water will be pumped from wells to a reservoir.

Special Reports of Water-Works.

Bristol, N. H.—From 1,000 to 2,000 ft. of mains will be laid, and 1 or 2 hydrants set this year.

Braintree, Mass.—S. A. F. MANSFIELD, Superintendent, informs us that the works are about to pass into the possession of the town.

Warehouse Point, Conn.—We are indebted to H. R. COOPER, Superintendent of the Thompsonville, Conn., Water Co., for the following:

The above company have let the contract for extending their works to Warehouse Point to Goodhue & Birnie, Springfield, Mass. Construction will be started July 15. Cost, about $30,000.

Otego, N. Y.—The following is from J. WARREN LAMB, Cooperstown, N. Y:

The Otego Water Co. are building works, taking the supply by gravity from Otsdawa creek and springs in the distributing reservoir. There will be 4½ miles of 6 and 4-in. pipe and 13 hydrants. The pipe is from the Jackson & Woodin Mfg. Co., Berwick, Pa., and the valves and hydrants are from the Eddy Valve Co. The yearly hydrant rental will be $25 each. W. H. PARKER, Otego, is President, and J. WARREN LAMB, Cooperstown, N. Y., is Constructing Engineer and General Manager.

Jamaica, N. Y.—JNO. LOCKWOOD, New York, informs us that the Jamaica Township Water Co. is extending its mains west to Morris Park, Richmond Hill, and through the adjacent territory. This company is entirely separate from the Jamaica Water Co.

Norwich, N. Y.—Surveys for a new reservoir are being made, but work will not be commenced before 1890.

Thomasville, Ga.—JAS. F. EVANS, Secretary, informs us that the works are being rapidly pushed to completion, 11,000 ft. of pipe having been laid in June.

Charleston, W. Va.—FRANK WOODMAN, Superintendent, informs us that a site for a reservoir has been bought, and that it is hoped construction will be begun this year.

Florence, Ala.—We are indebted to WM. H. BRUNDIGE, for the following:

On July 3 a contract and franchise for water-works was awarded to the Jeter & Boardman Water & Gas Association of Macon, Ga. There will be 13 miles of 16 to 6-in. pipe, 2 Worthington pumps of 1,500,000 galls. capacity each, 2 boilers of 100 H. P. each, and a stand-pipe 24 by 120 ft. The contract provides for 100 hydrants at a yearly rental of $45 each, for 30 years, and $40 each thereafter. [The Cypress Water-Works Co. built a small system in 1887.—*Ed. Eng. News.*]

Bellefontaine, O.—We are indebted to I. N. ZEARING, Secretary, for the following:

A new pumping station with 2 pumps, each of 750,000 galls. capacity, and 3,400 ft. of 12-in. mains have been added since January 1. The extensions cost $20,000.

Wilmington, O.—The following is from JNO. P. MARTIN, now at Wilmington:

The Council has passed an ordinance granting a franchise to MR. MARTIN. An election for ratification will be held Aug. 5. There will be 12 miles of 12 to 4 in. cast-iron pipe and 100 hydrants. The supply will be pumped to a stand-pipe from wells in the gravel, near a stream. The pumps will have a daily capacity of 1,500,000 galls., and the stand-pipe will be 20 by 125 ft. Population, 5,000. MR. MARTIN expects to begin work Aug. 10.

Washington, C. H., O.—A 3,000,000 gall. Worthington pump, and a Hawkins boiler will be used.

Lansing, Mich.—The extensions this season will be 7,300 ft. of 6-in pipe and 9 hydrants.

Marine City, Mich.—The annual report for 1888 shows: Total receipts for the year, $3,015: operating expense, $2,027. Extensions to cost $9,000 are in progress.

Owosso, Mich.—We are indebted to JNO. W. HILL, Cincinnati, who is the consulting engineer, for the following list of contracts awarded:

Pipe and specials, to Addyston Pipe & steel Co., Cincinnati, for $18,650, there being 602 tons of pipe and 20 tons of specials. Pipe laying, M. H. Myers, Hillsdale, Mich., for $6,078. Hydrants, 66 4-in., to Bourbon Copper & Brass Works, Cincinnati, for $1,716. Stop boxes, M. Walker, Port Huron, Mich., $104. Stop valves, Galvin Valve & Hydrant Co., Detroit, $582. Pumping station, M. H. Myers & Son $3 900. Crib and river connections, M. H. Myers & Son, $229. Pumping machinery, 2 compound non-condensing duplex steam pumps, 12 and 18½ steam, and 10-in. water cylinners, all of 12-in. stroke, and including boilers, Gordon Steam Pump Co., Hamilton, O., $6,470. Total of all bids, $37,729.

Pontiac, Mich.—H. G. MONROE, Superintendent, informs us that the extension for this season consists of 3,000 ft. of 8, and 6,000 ft. of 6-in. pipe.

Three Rivers, Mich.—We are informed by H. D. CUSHMAN, Secretary, that 9 driven wells, 4-in. in diameter by 96 ft. deep, will be sunk this season.

Rochelle, Ill.—A stand-pipe has been talked of, but the matter has not been decided.

North Des Moines, Ia.—The following is from JNO. MACVICAR, Mayor:

About a year ago the Council granted to local parties a charter to build and operate a water-works, the same to be completed July 1, 1889. The holders of the franchise engaged Dunham & Paine, Cleveland, O., who proceeded to build the works. After erecting a pumping station and laying about 5 miles of 6, 8, and 10-in. mains, the holders sold their franchise and works, so far as built, to the Des Moines Water Co., Des Moines. The new owners petitioned the Council to modify the charter to allow them to connect with their works in Des Moines. This the Town Council refused to do, at the same time enjoining the Des Moines Water Co. from in any way connecting the mains of the North Des Moines Water Co., with those of the Des Moines Water Co. In the face of the injunction the owners of the franchise made an unsuccessful attempt to connect the two pipe systems in the middle of the night. July 1, 1889, the Council annulled the franchise, previously granted, and have since passed an ordinance submitting to public vote the question of the town building and owning works. The vote will be taken July 20, and will probably be favorable, and doubtless bids will soon be asked, and construction begun.

Havana, Ill.—F. WM. RAEDER, St. Louis, Mo., informs us that he has been selected by the town as engineer for the new water-works, and has the plans and specifications completed. The town will advertise for bids at once.

Waukegan, Ill.—The mains are being extended about 2 miles.

Lexington, Ill.—A. B. DAVIDSON has sent us the following:

The City Council has refused to issue bonds, as the town charter is a special one, and does not authorize them to do so. An effort will probably be made to compel them to act by mandamus proceedings. The project is to pump from a well to a stand-pipe, for fire protection. Estimated cost, $7,000. Address CHAS. S. PREBLE. Population, 1,400.

Madison, Wis.—E. M. NICHOLS, Superintendent, informs us that a 2,000,000-gall. storage reservoir is being constructed, and that a stand-pipe to equalize pressure is projected. The latter will be 12 ft. in diameter by 130 ft. high.

Algona, Ia.—J. R. JONES, mayor, has given us the following:

Fairbanks, Morse & Co. are making surveys for water-works. It is thought that water will be pumped from a well to a tank, and that the town will build the works at a cost of about $10,000. Population, 2,500.

Marshalltown, Ia.—J. G. TROTTER, City Clerk, informs us that the mains will be extended this season by 3,500 ft. of 6-in. pipe, and that 10 hydrants will be placed. Experimental wells are being sunk.

Mason City, Ia.—We are indebted to A. R. SALE, Secretary, for the following:

The receiving reservoir is being deepened. The Water Committee, in their last annual report, recommended the sinking of a deep well for additional supply, as the present supply is not considered of good quality. If a flowing well should not be secured, a pump would necessarily be used. The average cost of pumping 1,000 galls., during the last year, was $0.071, nut coal being used.

Maquoketa, Ia.—About 860 ft. of 4-in. mains will be added.

Rock Rapids, Ia.—The following is from W. H. SMITH, Town Recorder:

E. E. FRIZZELL & Co. have a 20-years' franchise, providing for a yearly hydrant rental of $1,500, and also for the purchase of the works by the town at the end of 10 years, if desired. Water will be pumped from wells to a stand-pipe, at a cost of about $25,000. The works are to be finished Nov. 1. Population, 1,800.

Anoka, Minn.—Works are being built, with G. E. BEACH, Minneapolis, as engineer.

Duluth, Minn.—WM. CRAIG, Superintendent, has given the following:

A reservoir is being constructed, at an elevation of 287 ft. above the pumps. It has a capacity of 3,500,000 galls. Contracts have been awarded for 2,720 ft. of 20-in., 8,700 ft. of 16-in., 2,000 ft. of 8-in., and 8,700 ft. of 6-in. pipe, with necessary hydrants and valves.

Stillwater, Minn.—H. H. HARRISON, Secretary, informs us that the Council has voted to extend the mains 2¼ miles and to add 37 hydrants.

Two Harbors, Minn.—T. A. BARRY has sent us the following:

Water-works bonds to the amount of $20,000 have been issued by the village, and bought by the Duluth & Iron Range Railroad Co. Contracts will be let July 15, and the works finished Oct. 30. W. W. CURTIS, St. Paul, Minn., is the engineer. Water will be pumped from Lake Superior. The present supply is from the lake, distributed by carts. A. H. BLAKE is Chairman of the Village Council.

Council Grove, Kan.—The mains will be extended 2,000 ft. and a few hydrants placed.

Faulkton, Dak.—GEO. A. MORSE has sent the following:

GRAY BROS., Milwaukee, Wis., are sinking an artesian well for the village. Should the well give a sufficient supply and pressure, mains will be laid. Estimated cost, $10 000. Bonds have been voted. Population, 600.

Frankfort, Dak.—D. BROWN has given us the following:

The project is to secure a gravity system from a flowing artesian well. Cost, $5,000. Works would be owned by the village. No capital for construction has been secured. Population, 500.

Pierre, Dak.—J. W. TROY informs us that 2½ miles of 6 to 8 in. mains are being laid, and that 2 miles more of 6-in. pipe will probably be put in.

Beebe, Ark.—L. B. GIST informs us an artesian well is projected. If it should be a flowing well, water-works may be built. The enterprise is a private one.

Wynne, Ark.—C. M. MEBANE informs us that no definite steps have been taken to secure water-works. Eventually water will probably be pumped from a well to a tank.

Cuero, Tex.—An effort is being made to build works. Address D. H. HEATON, Chairman Water Committee.

New Birmingham, Tex.—Address the New Birmingham Iron & Land Co. for information.

Wichita Falls, Tex.—GEO. A. GIDDINGS informs us that one of the citizens has an artesian well down 100 ft., and proposes to continue it till water is found, if the other citizens will bear the greater part of the expense. It is not likely that anything else in the way of water-works will be done for some time.

Buena Vistar, Cal.—An extension to the State Reformatory works has been proposed, consisting of 1½ miles of 4-in pipe.

Walsenburg, Col.—The extensions this year and next will amount to 3½ miles.

Springer, N. M.—M. W. MILLS, President of the Agua Crystalina Co. has sent the following:

The reservoir and pump-house have been built and the pump and boilers bought. The company owns 70 lots of land. About $4,000 is needed to complete the works, one-fourth of which Mr. MILLS can furnish.

Carbon, Wyo.—An artesian well is in progress. There are no water-works.

Evanston, Wyo.—E. L. HALLOE, Jr., informs us that the town wishes to build water-works. There will be a reservoir.

Boise City, Ida.—GEO. W. BRIZEE has given the following:

EASTMAN BROS. have an irrigation system, the supply being taken from mountain springs. More springs are now being included in the supply. There are no other water-works. Population, 4,500.

Hailey, Ida.—Storage tanks, to give an additional head of 40 ft. have been projected.

Truro, N. S.—E. H. KEATING, Halifax, N. S., informs us that an enlargement of the works, after his plans, is now being made. A dam is being built, and the system is being changed from gravity to pumping.

Collingwood, Ont.—We are indebted to JNO. HOGG Town Clerk, for the following:

JAMES LINDSLEY is contractor for the works now being built by the town, and will complete them Dec. 1. JNO. GALT is the engineer. Water will be pumped from Georgian Bay to a stand-pipe. Estimated cost, $62,500. Capital was secured by issuing 5 per cent. 30-year debentures, which were sold at 105.54. Population, 5,200.

Kingston, Ont.—The following is from T. HEWITT, Superintendent:

In 1888 and 1889 there have been relaid 5½ miles of pipe. So far this year 4 miles of mains have been added, and 2 miles more will be put in. New pumps, suction pipe, and pumping station will be added.

Sarnia, Ont.—If a by-law, now before the people, to raise $7,200, is passed, the mains will be extended 12,000 ft.

Victoria, B. C.—A new 16-in. pumping main will be put in use July 1.

Worcester, N. Y.—An extension of about 1,000 ft. has been proposed.

Sippo Lake, from which the water supply of Massillon, O., is drawn, is reported as having an interesting history. It was constructed in 1845-46 as a feeder to the Ohio Canal. It is said that in 1853, citizens near by regarded it as a nuisance, and destroyed the dam at its mouth by gunpowder, sending a man on horseback to warn the people below that a flood was coming. Two or three buildings were wrecked, but no other damage done. Later the dam was rebuilt and the lake drawn upon for a water supply. The State Canal Commission has been looking up the records, and finds that the 600 acres of land flooded by and adjacent to the lake were originally purchased by the State at an average price of about $30 an acre. No record of a transfer to the city can be found, and the Canal Commission proposes to investigate the matter more fully, and to confer with the city authorities regarding a settlement.